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ABSTRACT

The model presented in this document integrates authentic assessment with traditional evaluation practices to create comprehensive assessment systems for elementary and secondary school students. Specifically, the model poses six categories of competencies that enjoy high levels of acceptance and construct validity: (1) knowledge of concepts, generalizations, processes, and strategies considered critical to specific content areas; (2) the ability to use complex reasoning processes; (3) the ability to gather and utilize information from a variety of sources in a variety of modes; (4) the ability to communicate effectively; (5) the ability to regulate one's own learning and development; and (6) the ability to work in a cooperative/collaborative manner. These competencies are meant to be assessed in three basic ways: through multiple validations, through secured tasks, and through portfolios. Implicit in this model is the identification of world class standards within content areas identified as important at the local, state, or national level. Six appendices, which comprise most of the document, provide definitions of 14 complex reasoning processes; subcompetencies of the 14 complex reasoning processes; benchmarks demonstrating student abilities in content areas; authentic classroom tasks; generalized rubrics for declarative knowledge; and elementary and secondary school tasks. (Contains approximately 85 references.) (LL)

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TOWARD A COMPREHENSIVE MODEL OF ASSESSMENT

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One of the truisms in American education is "that which is tested is that which is learned". Walter Doyle (1983) was perhaps the first to bring this to the public's attention in 1983 in his commissioned paper for the now famous report, A Nation At Risk (National Commission on Excellence in Education, 1983). Specifically, Doyle found that in American schools students soon discover that all things learned are not equal - you are tested on some and not on others. Not surprisingly, most students choose to ignore the learnings on which they are not tested. Additionally, teachers tend to consciously or unconsciously focus instructional energy on those learning outcomes that are prescribed (by the school, district or state). This tendency for assessment to shape instruction which in turn shapes learning has been documented by many others (Frederiksen & Collins, 1989; Shepard, 1989).

In and of itself, the tendency for assessment to shape instruction and learning is not necessarily negative. However, within American education, the types of competencies measured with traditional assessment instruments such as standardized tests do not match well with the competencies mandated by parents, legislators and the nation at large. On the one hand, the nation at large is demanding that public educators teach and reinforce a broad array of academic and nonacademic competencies; on the other, traditional forms of assessment focus on a fairly narrow range of academic competencies. For example, the national goals established by the National Governor's Association at the first Educational Summit meeting in 1990 cited competencies such as learning to use one's mind and complex reasoning as areas that must be improved by the year 2000. Similarly, the report from the Department of Labor entitled What Work Requires of Schools: A SCANS Report of America 2000 (Secretary's Commission on Achieving Necessary Skills,

1991) lists a broad array of both academic and nonacademic competencies such as:

- creative thinking
- decision making
- problem solving
- seeing in the mind's eye
- self management

Other national and regional reports have identified similar sets of diverse competencies. (Eisner, 1990; Goodlad, 1984; Resnick, 1987; Stiggins, 1991).

While there is great agreement about the need for reinforcing competencies like those listed above, there is also agreement that the current assessment system does not address them. This opinion has been expressed by many (e.g., Carey & Shavelson, 1989; Frederiksen & Collins, 1989; Shepard, 1989) and has been supported by research. To illustrate, in a series of studies at the Mid-continent Regional Educational Laboratory, 6,942 items from the Stanford Achievement batteries and the California Test of Basic Skills were analyzed to determine the extent to which they assess general cognitive competencies (Marzano, 1990; Marzano & Costa, 1988; Marzano & Jesse, 1987). It was found that of the 22 general cognitive competencies that were considered, items in the two test batteries assessed only nine of them. Of those nine that were covered, retrieval or recall of information was the mental ability most commonly assessed by a factor of 5 to 1 relative to the next most commonly assessed cognitive competency. In short, there is a growing body of theory to support the assertion that the current systems of tests measure a fairly narrow range of competencies limited to the academic domain.

From the discussion above we can conclude that a revolution in assessment is necessary given: 1) the need for schooling to reinforce a broad spectrum of academic and nonacademic competencies, 2) the tendency for assessment to drive instruction and learning, and 3) the strong pattern of current assessment procedures to focus on a small range of academic abilities. Indeed, such a revolution is currently underway within what might be loosely termed the alternative or authentic assessment movement. Wiggins (1989), for example, notes that the authentic assessment movement is widening the focus of traditional assessment to include a much broader set of abilities.

Given the recent inception of the authentic assessment movement, it is gaining momentum with incredible velocity. In fact, there is concern that schools and districts are rushing headlong into the implementation of so-called authentic forms of assessment without a clear understanding of what such assessment entails or without plans to account for the inherent weaknesses in such systems (Linn, Baker & Dunbar, 1991; Sven & Davey, 1990). For example, Williams and Phillips (1991) note:

> "Thus far, there are very few instances of performance [authentic] assessments that have been implemented in large-scale, public education programs that have attended to measurement issues. In fact, there appears to almost be a disdain for professional standards of technical quality among the more committed advocates of performance assessment, who believe that performance assessments should be implemented prior to consideration of technical quality" (p. 1).

Regardless of the pitfalls inherent in the authentic assessment movement, there have been great strides made in developing new techniques to accommodate the expanded notion of what should be assessed. In this paper we describe the efforts of the Mid-continent Regional Educational Laboratory to integrate the most current research and theory on authentic assessment with traditional assessment practices into a model that can be utilized by schools, districts and even entire states to create comprehensive assessment systems that cover the breadth of competencies called for by the nation at large. We begin with a discussion of the competency areas that should be included in a comprehensive assessment model.

THE COMPETENCIES INCLUDED IN AN AUTHENTIC ASSESSMENT SYSTEM

There has been a great deal of discussion as to the competencies that should be included in an authentic assessment system. Within this model six categories of competency have been identified. They are:

1) Knowledge of concepts, generalizations, processes and strategies that are considered critical to specific content areas.

2) Ability to utilize complex reasoning processes.

3) Ability to gather and utilize information from a variety of sources in a variety of modes.

4) Ability to communicate effectively through a variety of products.

5) Ability to regulate one's own learning and development.

6) Ability to work in a cooperative/collaborative manner.

These six categories appear to have face validity in that they have been mentioned as components in a number of authentic assessment models including those described by Baker, O'Neil and Linn (1991), Davey and Rindore (1990) and Linn, Baker and Dunbar (1991) among many others. Additionally, these six competency areas include those mentioned by Eisner (1991), Fiske (1990), Goodlad (1984), Resnick, (1987) and Stiggins (1991) as non-academic competencies necessary for success.

In addition to the fact that these categories of competency appear to have a high level of consensus regarding their importance, they also have some degree of construct validity from both information processing and systems perspectives. From certain information processing perspectives (e.g., Gagne, 1989; Sternberg, 1977), the six categories of competencies incorporate the major components involved in the acquisition and utilization of information. Specifically, most tasks require the initial gathering of information from a variety of sources (Category 3). The information gathered can usually be thought of as concepts, generalizations, processes and strategies (Category 1). Once information is gathered and integrated into the learner's existing knowledge base it is commonly applied in some manner. That is, the learner utilizes the information to solve some problems, make decisions and so on. All of these activities involve various types of complex reasoning (Category 2). Ultimately, a product (or products) is created within a learning experience. Some products are natural outgrowths of the task; others are generated for the sole purpose of communicating what has been learned (Category 4). Overseeing these highly interactive processes are a set of competencies that deal with such functions as identifying goals and subgoals, evaluating the effectiveness of one's actions, identifying subsequent actions and so on (Category 5). Finally, within most endeavors in life, human beings do not act in isolation. Rather, as social beings we commonly undertake tasks and solve problems as groups rather than as individuals (Category 6).

The six categories of competencies indigenous to authentic assessment, then, have some construct validity in terms of the extent to which they mirror the basic components of human information processing. Additionally, the six general categories of competencies parallel the basic functions within any open system. Specifically, using Miller's (1978) model of a living system, Hutchins (1991) has identified six basic functions inherent in all open systems. They are listed below along with the general competency areas to which they relate.

- accessing information (Category 3).
- interpreting or decoding information so as to integrate it into the system (Category 3).
- utilizing information to solve problems or address situations within the system (Category 2).
- producing tangible products to be used within the system (Category 4).
- regulating the interactions of elements within the system (Category 5).
- interacting with other entities beyond the boundaries of the system (Category 6).

To illustrate, any open system such as a school district, for example, must access information to survive. The district must have access to public opinion, the curriculum requirements imposed by the state, income tax regulations and so on. However, access to this information is not enough. Rather, the information must be integrated into the system such that specific persons and groups understand specific information. For example, curriculum directors in the district would necessarily have to understand the curriculum requirements from the state, the board of education would have to comprehend current sentiments of the public, and district lawyers and accountants would have to be thoroughly versed in tax laws. The information that had been integrated into the system would then be used to solve problems and make decisions. To illustrate, a curriculum committee might use the state requirements to help them decide how to structure the social studies objectives they are writing, or the board might use their knowledge of public sentiment to help make a decision on a new program being considered. Of course, a natural consequence of the flow of information and interaction of groups within a district is products. Hopefully, a basic product in any district is student learning. Other products would include reports, ceremonies, extra-curricular events and the like. To coordinate such a diversity of efforts, regulation and executive control is required. Well functioning districts have many levels of executive control with the superintendent and the school board commonly at the top of the control hierarchy. Finally, a district must interact and communicate with entities beyond its boundaries. Such interactions take the form of press releases, meetings with the business community, and so on. In short, all open systems appear to have at their core the six types of competencies that form the basis of the assessment model described in this report.

In summary, the underlying motivation for much of the authentic assessment movement is an emphasis on general competencies deemed important in modern society. The model proposed here includes six categories of competence that enjoy a high level of acceptance and construct validity from certain perspectives.

SPECIFIC COMPETENCIES WITHIN THE SIX CATEGORIES

Each of the six categories includes specific competencies. In this section the specifics of the six competency categories are discussed.

Category 1: Knowledge of Concepts, Generalizations, Processes and Strategies Considered Critical to Specific Content Areas.

One of the more dominant themes in the current calls for educational reform is enhanced knowledge of domain specific content. This is reflected in the six national goals. Specifically, Goal 3 of the six identified at the Educational Summit in 1990 states that students will master complex content in the areas of mathematics, science, English, history and geography by the year 2000.

Unfortunately, mastery of complex content is often translated into a knowledge of specific pieces of information. One might say that this is the impetus for such works as E.D. Hirsch's popular work, Cultural Literacy (1987). Such an emphasis is also reflected in Ravitch and Finn's work, What Do Our 17-Year-Olds Know? (1987). However, current research and theory on content-specific knowledge indicates that knowledge is somewhat hierarchic relative to the characteristic of generalizability and it is the information at the top of the hierarchy that is of the most utility. Specifically, knowledge within any content domain can be divided into two distinct types: declarative and procedural. Declarative knowledge can be thought of as knowledge of who, what, where, when and why (Anderson, 1983; Paris, Lipson & Wixson, 1983) and can be ordered hierarchically on the dimension of generality. At the "bottom" end of the hierarchy are facts about specific persons, places, things and events. At the "top" of the hierarchy are concepts and generalizations. For example, the statement that "John Kennedy was assassinated on November 22, 1963" is a fact. The statement that "holding high political office often puts the lives of those who hold them in jeopardy" is a generalization. Although facts are certainly important, generalizations are much more transferable. Quite obviously, the generalization about those in high political office can be exemplified across countries, situations and ages whereas the fact about Kennedy's assassination is event specific.

Procedural knowledge can also be ordered hierarchically on the dimension of generality. At the bottom end of the hierarchy are algorithms which have specific steps that must be executed in a rigid order. For example, the procedure for doing three column addition is algorithmic in nature. Again, algorithms are important and commonly must be learned to the level of automaticity to be useful. At the other end of the hierarchy are strategies that apply to a variety of situations. For example, the general strategy of analyzing a novel problem, relating it to known problems and identifying important differences is one that is applicable to a variety of situations (Sternberg, 1991).

In short, academic aptitude, once thought of as determined by a single general ability (Spearman, 1927), is now conceived of as the mastery of domain specific knowledge that is fairly independent of other content domains (Glaser, 1991). Although knowledge of the specific types of declarative knowledge (e.g., facts) and procedural knowledge (e.g., algorithms) are necessary to content area expertise, knowledge of the more general types of declarative knowledge (e.g., concepts and generalizations) and procedural knowledge (e.g., strategies) differentiates the expert from the novice. More pointedly, experts within a content area tend to approach tasks within their domain from a conceptual and strategic level whereas novices tend to approach these same tasks from a factual and algorithmic perspective (Anderson, 1990b; Smith, Adams & Schorr, 1978).

Category 2: Ability to Use Complex Reasoning Processes

Within what might loosely be called the "thinking skills" literature, there is general agreement that a distinction can be made between the mental processes that are used to acquire and integrate knowledge and those used to analyze and utilize knowledge (Marzano, et al., 1988). For example, knowledge integration involves such mental operations as relating new information to old information, recalling relevant details and creating mental representations of information. (The reader will note that competencies related to knowledge acquisition and integration are embedded within Category 3 of this model.) Knowledge analysis and utilization, on the other hand, involves mental operations applied to information that has already been acquired - operations that allow the learner to go beyond the simple assimilation of knowledge. It is during knowledge analysis and utilization that learning is perhaps most dramatic (Rumelhart & Norman, 1981; Vosniadou & Brewer, 1987).

Although there are certainly a vast number of cognitive operations that are oriented to knowledge analysis and utilization, there is a finite set that has particular utility to academic tasks. These operations include: comparison, classification, structural analysis, supported induction, supported deduction, error analysis, constructing support, extending, decision making, investigation, systems analysis, experimental inquiry, problem solving and invention. These fourteen processes have been adapted from the Dimensions of Learning project co-sponsored by the Mid-continent Regional Educational Laboratory and the Association for Supervision and Curriculum Development (Marzano, 1992; Marzano, et al., 1992). These processes are defined in Appendix A.

It is important to emphasize that the listing above does not represent or imply a continuum of skills, a hierarchy of skills, or even a discrete list of skills. Rather, the listing is offered as framework around which classroom tasks can be structured that stimulate complex reasoning and knowledge application. Specifically, it is not the processes of comparing, extending or decision making that are so important as the type of thinking and reasoning that comparing, extending and decision making stimulates about content. On the other hand, these processes do represent categories or types of thought that have identifiable characteristics. The importance of identified categories of thought that stimulate complex reasoning is stated rather strongly by Kulm (1991) as it relates to mathematics assessment. He notes that: "We need to be able to define and categorize fundamental higher-order thinking processes in mathematics, as well as other important processes that have specific applications in mathematical contents" (p. 3). That the mental processes listed above stimulate complex reasoning within the content areas to which they are applied has been illustrated by a number of theorists and researchers (Anderson, 1990; Beyer, 1988; Halpern, 1984; Mervis, 1980; Paul, 1990; Stahl, 1985; Toulmin, Rieke & Janik, 1981;).

Thus, a task that was designed to stimulate complex thinking within the field of history might be organized around the mental process of "investigation" like that below.

> While England was the first country to begin industrializing in the late 19th century, a number of countries did not start until late in this century. As non-industrialized countries now begin to become industrialized, it's essential that we understand what effect such industrialization might have on the country in question as well as its effect on the world community. Select one country in the early stages of industrialization and describe those changes that we can predict with certainty. Identify those areas that give rise to the greatest concerns about the wisdom of transforming that society to an industrial society. Describe a scenario that might provide the best of both worlds for the country -- the benefits of an industrial society without its hazards.

Similarly, a task designed to stimulate complex reasoning in science might be organized around supported induction similar to that below:

> Green plants produce their own food by taking energy from the sun and using air, water and minerals from their environment. Animals eat plants and other animals. When animals die they decompose and form part of the organic nutrients in the soil. What generalizations can you make about how energy flows through an ecosystem? Describe the specific points you used in drawing your conclusion and the reasoning behind it.

Within each of the fourteen types of mental competencies one can identify subcompetencies necessary for successful execution of the process. To illustrate, consider the subcompetencies inherent in experimental inquiry:

a) Ability to explain an observed phenomenon using appropriate facts, concepts and generalizations.
b) Ability to make predictions that logically follow from the explanation.
c) Ability to construct and carry out an activity or experiment that tests the prediction.
d) Ability to relate the outcome of the experiment to the initial explanation.

In this model, these characteristics are referred to as subcompetencies and can be thought of as necessary elements of a process or procedure. Thus, each of the fourteen competencies mentioned above have subcompetencies. (These are described in Appendix B). The convention of identifying subcompetencies with complex competencies has received considerable attention from Sternberg in his analysis of human intelligence (Sternberg, 1977, 1984). It has also been used by the National Assessment of Educational Progress to focus assessment in various content areas (Mullis, Owen & Phillips, 1990), particularly in the areas of reading and writing assessment (Applebee, Langer & Mullis, 1986a, 1986b).

In summary, this model defines complex reasoning as the ability to apply knowledge in specific content areas via the application of fourteen competencies, each of which has subcompetencies. Complex reasoning, then, can be operationally defined as involving fourteen general types of mental operations each of which requires the utilization of specific component competencies.

Category 3: Ability to Gather Information in a Variety of Ways from a Variety of Sources.

Gathering information or data is central to all complex tasks. Relative to school-related tasks, the most commonly employed data gathering processes are reading and listening. Of course, the process of reading and the subcompetencies involved have been studied for years. In recent years there has been a considerable shift from an emphasis on the conventions and lower level "atomistic" subcompetencies such as a knowledge of letter/sound relationships and conventions of the English language to more "top level" active subcomponents of the reading process such as:

- previewing information before reading and generating predictions.
- reading to confirm or disconfirm predictions.
- distinguishing between relevant and irrelevant information.
- recognizing and clearing up confusing parts.
- creating mental pictures of what is read.
- summarizing or synthesizing what has been read.

Additionally, within the assessment literature there is increasing interest in assessing students' abilities to apply the reading process to different types of discourse such as narration, exposition, poetry and so on (Applebee, Langer & Mullis, 1986a). The competency of reading, then, as it relates to authentic assessment, can be defined as an array of top level information processing subcompetencies that can be applied to a variety of types of written information.

The competencies involved in listening are commonly considered analogous to those involved in reading with the notable difference that information is obtained through the auditory versus the visual mode. Consequently, the competency of listening does not require any "code breaking" of English orthography or a knowledge of certain textual conventions such as the layout of a book. However, the competency of listening does require the execution of subcompetencies such as making predictions, listening to confirm or disconfirm predictions, distinguishing between relevant and irrelevant information and so on. Although not addressed with as much emphasis as reading and listening, there are a number of other information gathering competencies that have been identified as important (Berk, 1986; Finch 1991b). These include:

- making observations.
- developing and administering questionnaires.
- utilizing various types of data bases.
- conducting interviews

While on the surface these competencies look different from each other and from the competencies of reading and listening, they have many subcompetencies in common. For example, all of the forms of information gathering above share at least the following subcompetencies:

- ability to determine when additional information is useful or necessary
- ability to retrieve information from resources
- ability to assess the value of information
- ability to interpret and synthesize information

The competencies within the general category of gathering information, then, have some common and some unique subcompetencies. One might conclude that assessment can be focused on either the unique subcompetencies in a set of competencies, the common subcompetencies or both.

Category 4: Ability to Communicate Effectively through a Variety of Products.

Just as most complex tasks involve the collection of information, so too do they commonly involve the creation of products. Some products are strictly mental (e.g., conclusions) and, consequently, not necessarily tangible. This is particularly true of the products of the fourteen complex reasoning competencies described in Category 2. For example, the product of a comparison task is a conclusion or conclusions about the similarities and differences between the elements that were compared. Within a structured learning situation such as school, it is usually required that the learner communicate conclusions for the benefit of both the teacher and the learner. Communication, then, renders intangible mental products tangible. Additionally, it benefits the teacher in that it provides raw data with which to assess the learner's mental performance. It benefits the learner in that communicating conclusions forces the learner to express thought as language--a representational process that a number of researchers and theorists assert forces a level of clarity of thinking that cannot be attained without the imposition of the process (Nickerson, 1984; Scardamalia & Bereiter, 1983, 1986). The most common type of tangible communication in schools is a written or oral report. Of the two, writing has been studied most extensively (Flower & Hayes, 1980a, 1980b, 1981; Hillocks, 1989). As in the case of reading, the attention within writing has shifted from bottom-level, atomistic subcompetencies such as a knowledge of specific written language conventions to top level subcompetencies that are more active components of the writing process:

- ability to communicate to diverse audiences
- ability to communicate to serve a variety of purposes
- ability to communicate effectively through the application of quality criteria

Just as listening shares basic subcompetencies with reading, so too does speaking share basic competencies with writing. That is, when speaking as when writing, the learner must specify a clear theme or main idea and support that theme or main idea.

Although not used as commonly as written and oral reports, the following are also legitimate ways of communicating the conclusions of a task:

- a panel discussion
- a dramatic presentation
- a videotaped documentary
- a simulation
- a debate

Again, just as the various information gathering competencies (Category 3) share common subcompetencies, so too do those included in this category. That is, it can be said that all of the communication competencies listed above share the three subcompetencies listed for writing.

In short, each of the competencies in this category have unique subcompetencies, as do each of the competencies in Category 3. Additionally, all share common competencies just as all competencies in Category 3 have commonalities. Again, assessment may focus on shared subcompetencies, unique competencies or both.

Category 5: Ability to Regulate Oneself

Perhaps the most important competency area is the ability to regulate oneself. It is important because it cuts across all tasks regardless of the type. That is, for the most effective behavior a learner must regulate himself while engaging in complex reasoning, while gathering information, while communicating conclusions and so on. Within the literature on cognition this self-regulating ability receives such labels as executive control and metacognition. Drawing from the works of Amabile (1987), Brown (1978, 1980), Ennis (1985, 1987, 1989), Flavell (1976, 1977), Paul, et al. (1986, 1989), and Perkins (1981, 1984, 1985), in the areas of self efficacy, critical and creative thinking, a rich array of self-regulatory competencies can be identified. These include:

- ability to seek different perspectives and consider choices before acting.
- ability to push the limits and persevere in difficult situations.
- ability to establish clear goals and manage progress through achieving them.
- ability to generate and pursue personal standards of performance.

Unlike the competencies in the other categories, these do not appear to lend themselves to subcompetencies. Rather, as Ennis (1989) and Costa (1984) assert, these competencies are best viewed as mental habits or dispositions to behave in a certain way under certain conditions. From this perspective they are difficult to teach because they do not lend themselves to a procedural description. That is, they are not amenable to being described as algorithms, processes or strategies. Rather, they are more accurately described as responses to internal states and, thus, are difficult to assess. For example, a learner exhibits the disposition of working at the edge rather than the center of her competence when she notices that she is not setting or adhering to challenging standards. Unlike the other categories then, the competencies within this category do not appear to share common aspects of a generic process or common subcompetencies as we have referred to them in this model.

Category 6: Ability to Work in Cooperative/Collaborative Groups.

One of the major educational realizations within the past decade is that in the "real world" many tasks are performed by groups as opposed to individuals working independently. Although research on the utility of cooperative learning was already well developed by the 1920's, it is because of the work of such individuals as Slavin (1983) and Johnson and Johnson (Johnson & Johnson, 1986, 1987; Johnson, Johnson, Roy & Holubec, 1984) that the role of cooperation and collaboration has been well articulated within education. Specifically, competencies such as the following have been identified as necessary for effective cooperative/collaborative work:

- ability to work toward the achievement of group goals
- ability to contribute toward group maintenance
- ability to communicate interpersonally
- ability to self-assess and monitor own behavior

Like the competencies with self-regulation these do not appear amenable to subcompetency. Again, they are more dispositional and less procedural in nature.

In summary, the six general competency areas each have identifiable competencies. Additionally, some competencies within categories share subcompetencies. Any comprehensive assessment system would necessarily address ways of gathering data on these competencies and using this data to assess students.

THE ROLE OF DOMAIN SPECIFIC KNOWLEDGE

A cursory reading of the six competency areas might lead to the false impression that domain specific or content specific knowledge has been placed in a secondary role in lieu of more general (e.g., complex reasoning) or non-academic (e.g., self-regulation) competencies. On the contrary, it is an assumption of this model that the six general competency areas take on meaning only as they are applied to domain-specific tasks. Specifically, the use of concepts, generalizations, processes and strategies (Category 1) takes on meaning when applied to a specific content area such as mathematics or geography. The use of complex reasoning processes (Category 2) such as problem solving and invention is meaningful when applied to a specific content area such as English or science. Similarly, the effective collection and synthesis of information (Category 3) and the effective reporting of conclusions (Category 4) is meaningful in terms of a content specific task. Finally, self-regulation (Category 5) and cooperation/collaboration (Category 6) also obtain meaning in the context of domain-specific tasks, although these two categories have certainly been identified as important in and of themselves.

Content specific knowledge, then, is a centerpiece of any comprehensive assessment system. In fact, domain specific knowledge is important enough that it can and should, on occasion, be measured in isolation. In other words, Category 1 as it applies to specific content areas, can legitimately be the sole focus of assessment. Where it is not advisable to measure complex reasoning (Category 2) or self-regulation (Category 5) or collaboration (Category 6) in isolation, it is sometimes necessary to measure content specific declarative and procedural knowledge (Category 1) in isolation of the others. (The reader should note that two major exceptions to this generalization occur for reading within Category 3 and writing within Category 4, both of which are frequently assessed in isolation.)

Facts, concepts and generalizations (declarative knowledge) are assessed in isolation when the purpose of assessment is to evaluate the extent to which students understand the declarative knowledge deemed important in a content area. For example, if the purpose of assessment is to determine the extent to which students understand the concept of democracy in a history course, the concept could legitimately be assessed in isolation without including assessment of complex thinking, information gathering and so on.

The need for highly focused assessment is even more important as it applies to procedural knowledge. Specifically, research indicates that learning procedural knowledge, whether it be algorithmic or strategic in nature, is a long term process that advances through stages of development (Anderson, 1983, 1990) Consequently, a learner cannot be expected to apply procedural knowledge until he has reached a level of competence at which the procedure can be executed with relative ease (in the case of a strategy) or with little conscious thought (in the case of an algorithm). Procedures, then, must be developed to a high level of competence before they can legitimately be assessed in the context of a task that involves the use of additional and possibly confounding competencies such as complex reasoning (as defined in this model), information gathering, self-regulation and so on. This implies that within a comprehensive assessment system a good deal of time and energy will necessarily be spent on assessing learners' abilities to execute content specific procedures. In fact, the first discussions of "performance assessment" were in relation to specific procedures within specific content domains (Fitzpatrick & Morrison, 1991, Siegel, 1986).

From the discussion above, one can conclude that the identification of important declarative and procedural knowledge within specific content areas is a necessary condition for the effective implementation of a comprehensive assessment system. This work is currently underway in a variety of content areas, spurred on by President Bush's exhortation for "world-class" standards (Bush, 1991). For example, the Geographic Education National Implementation Project (1989) has identified geography standards like the following:

- understanding that distribution of resources varies from place to place.
- understanding that people perceive the environment in different ways.
- understanding that places have human characteristics.

The American Association for the Advancement of Science (Clark, 1989) has identified standards for biology and the health sciences such as the following:

- understanding of the role of sense organs, brain and musculature in human behavior
- understanding that the basic processes of life occur at the cellular level.

Appendix C provides a list of standards that are emerging within specific domains. These standards have been developed and synthesized from a review of the works of national study groups as well as selected state curriculum frameworks. A full bibliography of these documents is found at the end of Appendix C.

Even a cursory analysis of these lists illustrates that they are at a high level of generality. In other words, the efforts of experts to identify world-class standards in specific domains has translated into the identification of concepts, generalizations, processes and strategies as opposed to facts and algorithms within those domains. This movement in curriculum is a marked change from the minimum competency emphasis of the early 1980's that was focused on facts and algorithms and, unfortunately, crept into the interpretation of some mastery learning frameworks

(Huynh, 1985). In fact, this shift in perspective from minimum standards to more general "world-class" standards is explicit in the efforts of the National Council of Teachers of Mathematics (NCTM). To illustrate, Figure 1 lists some of NCTM's descriptions of the shift in curricular emphasis within the current standards.

Figure 1

From an emphasis on . . .	To an emphasis on . . .
o rote memorization of rules	o justification of thinking
o naming geometric figures	o understanding properties of geometric figures
o long division, addition, subtraction and multiplication as algorithms	o use of calculator for complex computations and selection of appropriate computational methods

The identification of world class standards, then, implies the identification of high level concepts, generalizations, processes and strategies within specific content domains. The emphasis is made explicit by Category 1 within this model.

ASSESSING THE SIX CATEGORIES OF COMPETENCIES

The task of assessing the six competency areas is quite obviously a difficult one, certainly one for which no single assessment format would be sufficient. In fact, as early as 1960, Cronbach (1960) asserted that assessment should utilize a variety of techniques, give heavy weight to observation and utilize the integration of information to draw conclusions about individual students. In this model three different formats for assessing the six competency areas are utilized: 1) multiple validations, 2) secured tasks and 3) student portfolios. Following Cronbach's recommendations, a basic assumption of this model is that all three formats must be used in concert for a truly robust assessment system.

MULTIPLE VALIDATIONS

Multiple Validations refer to multiple assessments, over time, of the six competency areas by classroom teachers. This is the basic system used by Alverno College (Mertkowski, 1991). Within this model there are four types of data used for multiple validations: 1) naturalistic observations, 2) student self-reports, 3) teacher-made tests, and 4) authentic classroom tasks.

1. Naturalistic observation:

Naturalistic observations occur as teachers and students go about their daily work. In short, teachers simply look for and record behaviors that provide evidence of student performance in the six competency areas. For example, while students work on cooperative projects that have been constructed by the teacher or orchestrated by the students, the teacher might pay particular attention to student interactions, recording specific behaviors or interpretation of specific behaviors that would allow the teacher to assess the competencies of cooperation. Similarly, while students work on a long term project the teacher might note student behaviors that indicate competence or lack thereof in the area of self regulation. In short, naturalistic observational data is obtained from natural classroom situations in which students exhibit behaviors that can be interpreted as evidence to support or refute their ability in the six competency areas.

2) Student Self-Report

It is within the past decade that student self-assessment or self-report has received serious consideration as a valid means of assessment. It was probably Peterson, Swing, Stark and Waas' (1984) study on student's assessments of their on and off task behavior that drew attention to the fact that students can accurately assess their own behavior and ability. It has received considerable attention within the writing process movement. For example, Tierney, Carter and Desai (1991) assert that student self-assessment is at the heart of the authentic assessment movement.

Relative to the six competency areas, there is no reason why students cannot rate themselves in all six areas (although traditionally, Categories 1 and 2 have been considered the sole domain of the teacher). For example, while studying a complex concept such as "entropy" in science, students might be asked to rate their understanding of the topic. Similarly, while engaged in solving a problem students might be asked to assess the extent to which they have engaged in effective reasoning strategies such as identifying the desired goal implicit in the problem and articulating the constraints or conditions within the problem. One powerful tool to this end is student journals. Of course, journals have been used extensively as a vehicle for literacy development (Atwell, 1987; Calkins, 1986; Macrorie, 1984). However, Marzano (1991, 1992) has recently described how they can be used as a vehicle and repository for student self-assessments. This is accomplished through the use of probes. A probe is nothing more than a question asked by the teacher to elicit a student self-assessment for one of the six competency areas. For example, below are listed sample probes for each of the six competency areas:

> Category 1: "Describe the extent to which you understand the information we have covered about tornadoes. What are you confused about? What are you confident about?"
>
> Category 2: "Describe how effective you have been so far in your investigation task."
>
> Category 3: "Describe how effective you have been in gathering information for your project."
>
> Category 4: "Describe how effective you have been in communicating your conclusions."
>
> Category 5: "Describe how well you have used the competencies of self-regulation throughout your project."
>
> Category 6: "Describe how well you have worked with your group throughout your project."

Students record their responses to probes such as these in their journals. The teacher then periodically collects the journals to review student responses to probes or the teacher and student meet in a conference situation to discuss student responses. Thus, student responses as well as student/teacher conferences about those responses can serve as assessment data for the six competency areas.

3) Teacher-Made Tests

Some teachers incorrectly assume that the authentic assessment movement implies an end to traditional forms of teacher developed tests that utilize multiple choice, short answer and true/false items. This is an erroneous assumption. Teacher-made tests are still a powerful assessment device for competency area 1, ability to use content specific concepts, generalizations, processes and strategies. In fact, teacher-made tests relying on multiple choice, true/false, matching and fill in the blank item formats are a necessary tool for assessing students' understanding of declarative content, simply because they are highly focused and efficient Consequently, to assess student's knowledge of probability and its applications a teacher might want to construct a test that utilizes short answers or multiple choice formats. This does not mean, however, that teacher-made tests would be the only type of assessment or even the most prominent method of assessing content area expertise. In this model, the most prominent method is authentic classroom tasks.

4) Authentic Classroom Tasks

Authentic classroom tasks are powerful devices for assessing any or all of the six competency areas. In fact, an ideal authentic classroom task would include all six areas. For example, in a science class a teacher might construct a task that deals with the generalization that weather affects many aspects of our lives. Thus, the task would address competency area 1 - content area concepts, principles, processes and strategies. To address competency area 2, a teacher might organize the task around the complex reasoning process of experimental inquiry. Such a task might be stated as follows:

Some people believe that weather/climate affects people's personality/moods:

a) Describe something you have noticed about the relationship between weather/climate and personality or mood. Explain what you think is happening.

b) Then make a prediction based on your explanation.

c) Next, gather information to test your prediction.

d) When you have gathered the information, describe the extent to which it agrees with your prediction.

e) Finally, describe what you learned from your study.

To include the competency area 3 - collecting data from multiple sources, the teacher might require students to use information from at least three of the four following sources: personal interviews of people, videotapes in the library, articles that have been placed on reserve in the library and their own personal experiences. Emphasizing the competency of communicating through a variety of products (Category 4), the teacher might ask students to communicate their findings using at least two of the following:

- a debate
- a slide show
- an essay
- an oral report
- an audiotape
- a simulation

Emphasizing the competency of self-regulation (Category 5), the teacher might ask students to submit a formal plan for their projects and evaluate the effectiveness of their actions. Finally, emphasizing the competency of cooperation/collaboration (Category 6), the teacher might ask students to work in cooperative groups paying particular attention to specific competencies as they did so.

It is important to note that classroom tasks like this commonly have two defining characteristics in addition to the characteristic that address the six competency areas. These characteristics are: 1) they tend to be relatively long term in nature and 2) they tend to be relevant to the interests of students.

The characteristic that they are long term means that authentic classroom tasks take longer than a single class period. Certainly, the experimental inquiry task described above would require a great deal of time and energy. Frequently, such tasks take two weeks, three weeks or even longer. In fact, some theorists such as Jaques (1985) believe that it is only during the execution of relatively long term tasks that the most effective knowledge development can occur.

The final characteristic of authentic tasks is that they are relevant to the student. This is a prerequisite to generate the motivation required for students to exhibit the demanding competencies implicit in authentic classroom tasks. On the negative side, if a student is not interested in a task, she will probably not work very hard at gathering information, reasoning in a complex fashion and so on. On the positive side, interest in a task will increase the probability that a student reasons in a complex manner, gathers information in a rigorous fashion and so on. To facilitate student interest it is usually necessary to maximize the amount of student control over the task. Specifically, recent research by Harter (1982) and McCombs, 1986, 1987; McCombs & Marzano, 1990) indicates that students' control is a primary and perhaps necessary condition for the generation of the type of motivation required to successfully complete tasks such as those described in this section.

CONSTRUCTING AUTHENTIC CLASSROOM TASKS

Although (as the above example illustrates) it is possible to construct an authentic classroom task that incorporates all six competency areas, more often than not a classroom task will focus on a subset of the competencies. For example, the teacher might structure a task that focuses on a specific concept (Competency area 1) and use the complex reasoning process of process of investigation (Competency area 2). Finally, it would be done in cooperative groups (Competency area 6).

In addition to restricting a task in terms of the competencies it emphasizes, a teacher would no doubt restrict those areas that are formally assessed. For example, even though the task covered competency areas 1, 2 and 6, a teacher might choose to assess only competency areas 1 and 2, or competency areas 1 and 6.

Although there are many ways that a teacher can construct an authentic task, four methods seem to be most frequently used.

Method 1: Focus on Content and Reasoning:

This method is utilized within the Dimensions of Learning model developed by ASCD and McREL (Marzano, 1992; Marzano, et al., 1992). Within this method the teacher first selects the domain specific content (Category 1) that will be the focus of the authentic classroom task. For example, within a history class a teacher might select the generalization that Queen Isabella was more interested in enhancing the trading capacity of her country than she was in supporting exploration when she funded Columbus' expedition. Next, the teacher selects a complex reasoning process that is best suited to exploration of the information that has been selected. In this case the teacher might select the process of decision making. A task is then written from the perspective of the complex reasoning process. For example, the decision making task that focuses on the generalization about Queen Isabella might be:

> You are Queen Isabella and must decide whether Columbus should be funded. You should not use benefit of hindsight, but work only with what was available to Queen Isabella at the time. Your primary concern as Queen is to keep the public treasury sound and to work for the public good. However, you are also very interested in establishing new trade routes. You should consider the costs of an ocean venture both in monetary terms and possible loss of life. There are no guarantees of success. Make the choice and defend it.

If the teacher wishes other competency areas (e.g., Categories 3, 4, 5 and 6) to be included in the task, she then adjusts it to compensate for these additions. For example, if the teacher wanted to include cooperative/collaborative competencies in the task she would then structure it so that students work in cooperative groups. If the teacher wanted to include information gathering competencies in the task, she would structure it so that students have to gather information from a variety of sources to complete the task.

Method 2: Focus on Product or Production:

This method is the basis of many thinking skills programs that emphasize inventiveness (Torrance, 1986). Additionally, Fanning (1992) has adapted the model to a variety of content areas across a variety of grade levels. While focusing on production, students engage subject matter through a process Fanning calls purposeful inquiry. The aim of purposeful inquiry is to give learners the opportunity to gain a sense of personal control by creating phenomena that are perceived as relevant and useful to themselves and/or others. Learners become mindfully involved in influencing the outcomes during this process, which seems to enhance their sense of competence (Langer, 1983) and personal motivation (Glasser, 1984). The initial step in developing an authentic task is the identification of the basic topic. For example, a teacher or students might decide, as part of a unit on catastrophic events, that they wish to study the topic of predicting tornadoes. It is important to note that even though this method begins with content information like Method 1, here the topic is much more general. That is, in Method 1, the first step is driven by the specification of a high level concept or generalization. In Method 2, a general area of investigation is identified but specifics are not. Thus, the dynamics of the tasks constructed using Method 2 are more divergent than they are in Method 1. Once a general area of investigation is selected, learners and teachers then determine or interpret (van Manen, 1990) the significance and meaning of the topic to themselves and people in general. Once relevance has been established, a product is identified. Commonly the product is focused around answering such questions as "what would be a new way of . . . " or "what would be a better way of . . ." For example, relative to the general topic of tornadoes, the teacher or students might determine that they would like to produce a better way of warning the community about impending tornadoes. The production process engaged in by the learners, in this case the design and development of a tornado warning system, becomes an effective organizing center around which both declarative and procedural knowledge (MacDonald, et al. 1965) can be focused. The production process becomes the basic thrust of the task. Although no complex reasoning processes are explicitly identified, they are implicit in the task. Indeed, most new products utilize the process of invention as described in Appendix A. Standards for successful completion of the product are set and a process to complete the goal is identified. Again, if the teacher or students wish to overtly incorporate other competency areas such as collaboration, the task is modified.

Method 3: Focus on Gestalt:

This method is the basis for much of the authentic assessment work done by the Connecticut Department of Education (Baron, 1991). Within this model no framework is used *a priori* in the planning of classroom tasks. Rather, expert teachers within content domains gather and identify tasks that would be of interest within their domain. In effect, experts within a content area gather or answer the question: "What is an interesting and legitimate task that would be appropriate within our content area?" Without any regard to fitting the task into a framework, a task is then constructed by the group of experts. For assessment purposes the task is then analyzed to determine the competencies that are involved; in effect, the experts engage in a detailed task analysis. From the perspective of this model, the task analysis would involve determining:

- the specific concepts, generalizations, processes and strategies necessary to complete the task (Category 1).

- The specific reasoning processes necessary to complete the task (Category 2).
- The specific information gathering competencies necessary to complete the task (Category 3).
- The specific communication and product development competencies necessary to complete the task (Category 4).
- The specific self-regulation competencies necessary to complete the task (Category 5).
- The specific cooperative/collaborative competencies necessary to complete the task (Category 6).

Method 4: Focus on Student Exploration:

This method shifts the responsibility for constructing authentic classroom tasks from the teacher to the student. It is the focus of the model developed by ASCD and McREL (Marzano, 1992; Marzano, et al., 1992) referred to as Dimensions of Learning although, as mentioned previously, that model also utilizes methods which focus on content and reasoning. This method of creating an authentic classroom task is also implicit in most of the theory on instruction for gifted students (Renzulli, 1977) and multiple intelligences (Gardner, 1983). In effect, within this method students utilize the process outlined in Methods 1 or 2 to write their own authentic classroom tasks. For example, using Method 1, students would identify a topic they wished to study. They would then identify the complex reasoning process that would be most beneficial in helping them study the identified topic. To facilitate the identification of the complex reasoning process around which a task will be constructed, students frequently find the questions listed below quite useful.

Comparing:	How are these alike? How are they different?
Classifying:	What groups can I put things into? What are the rules governing membership in these groups?
Structural Analysis:	What is the main idea or what is the most important information? What is the dominant pattern? What are the supporting patterns? What are the supporting pieces? How are the pieces related?
Supported Induction:	What conclusions/generalizations can you draw from this and what is the support for these conclusions? What is the probability for this and what is the support for that conclusion?
Supported Deduction:	What has to be true given the validity of this principle? What is the proof that this must be true?
Error Analysis:	What's wrong with this? What are specific errors that have been made? How can it be fixed?
Constructing Support:	What is the support for this argument? What are the limitations of this argument?
Extending:	What's the general pattern of information here? Where else does this apply? How can the information be represented in another way (graphically, symbolically)?
Decision Making:	What/whom would be the best or worst? Which one has the most or least?
Investigation:	What are the defining characteristics (definitive)? Why/how did this happen (historical)? What would/would have happen/ed if (projective)?
Systems Analysis:	How does this operate? What are the relationships among the components? What effect does one part have on another?

Problem Solving:	How can I overcome this obstacle? Given these conditions, what can I expect the answer to be?
Experimental Inquiry:	What do I observe? How can I explain it? What can I predict from it?
Invention:	How can this be improved? What new thing is needed here?

Rather than think in terms of the reasoning processes per se, students think in terms of interesting questions they would like to answer. The students then construct their tasks and adjust them to add emphasis in Categories 3, 4, 5, and 6 as they see fit.

Using Method 2, students identify the topic they would like to study and the product they would like to produce. Again, the task is constructed and then revised to accommodate competency in categories 3, 4, 5 and 6 as the student desires.

In summary, there are a number of ways that authentic classroom tasks can be constructed utilizing the six competency categories described in this model. Appendix D contains examples of authentic classroom tasks organized around the fourteen complex reasoning processes.

KEEPING TRACK OF PERFORMANCE

Given the diversity of authentic classroom tasks and the specificity of the six competency areas, it is quite evident why multiple validations are necessary. Simply stated, no one teacher could cover all six categories and their competencies and subcompetencies with the requisite level of rigor in a semester or probably even a year's period. Over time though, assessments made across teachers could provide a complete profile of a student in all six areas. For example, a single seventh grade student might take six classes in the course of a day. Throughout the semester the student's teachers might assess the six competency areas in the pattern designated in Figure 2.

According to Figure 2, Teacher A (Mathematics) has assessed complex reasoning and self-regulation once and cooperation and the standards within mathematics four times. Teacher B (Science) has assessed the standards in science three times, the competencies in complex reasoning once and so on. Thus, over the semester interval the student would have received the following assessments:

Math Standards	4
Science Standards	3
Social Studies Standards	3
Geography Standards	2
English Standards	4
Technology Standards	4
Complex Reasoning Standards	8
Gathering Information Standards	5
Communication/Products Standards	7
Self Regulation Standards	3
Cooperation/Collaboration Standards	3

Figure 2

	Teacher A (Math)	Teacher B (Science)	Teacher C (Social Studies)	Teacher D (Geography)	Teacher E (English)	Teacher F (Technology)
Math (1)	4					
Science (1)		3				
Social Studies (1)			3			
Geography (1)				2		
English (1)					4	
Technology (1)						4
Complex Reasoning (2)	1	1	2	1	2	1
Gathering Information (3)		1			3	1
Communication/ Products (4)		2	2	1		2
Self-Regulation (5)	1		1			1
Cooperation/ Collaboration (6)	1		1			1

Note: The numbers in parentheses represent the six competency categories.

This pattern of multiple validations has the benefit of allowing for an estimation and possible correction of error due to rater unreliability. Specifically, even under the assumption that teachers are trained in assessing each of the six competency areas via controlled practice in the application of specific rubrics (this is discussed in a subsequent section), there is sure to be a certain amount of error variation from rater to rater (teacher to teacher) due to such factors as rater bias, lack of rater competence, lack of sufficient information and so on. Theoretically, multiple validations allow for the estimation of such error. Specifically, under the assumption that characteristics within the six competency areas either develop in a linear fashion or are stable across tasks, one would expect the assessments over time and across teachers to have a strong linear trend. (Note that the only competency that would probably not meet the assumptions of linearity would be domain specific knowledge given the independence of the various concepts, generalizations, processes and strategies within a given content area). Any deviation from linearity, then, could be interpreted as evidence of rater error.

THE NEED FOR RUBRICS AND PERFORMANCE STANDARDS

It is intuitively obvious that the extent to which classroom teachers can agree on their assessments of student performance in the various competency areas is a function of the extent to which detailed rubrics have been developed for each area. A rubric is a system of descriptors that operationalize the levels of performance relative to a specific competency or subcompetency. For example, consider the general competency area of collaborative worker. Recall that component competencies were:

- o ability to work toward the achievement of group goals.
- o ability to contribute toward group maintenance.
- o ability to communicate interpersonally.
- o ability to self-assess and monitor own behavior.

It is these competencies that are the subject of assessment. That is, rather than assess the general domain of collaborative workers within an authentic classroom it is much more valid, given the complexity of the construct, to assess its characteristic competencies. For each competency (or subcompetency) then, levels of performance must be articulated. It is the description of these levels of performance that we refer to as rubrics. For example, below are listed the rubrics for the self regulatory competency of "self-assesses and manages own behavior."

Self assesses and manages own behavior

4 Carefully assesses personal strengths and assumes responsibilities accordingly; knows when to provide leadership and when to set up opportunities for others to lead; knows when to speak and when to listen.

3 Assumes responsibilities consistent with personal strengths; expresses enthusiasm but does not dominate; tries to strike a balance between speaking and listening.

2 Takes on roles that do not always accord with personal strengths; tends to monopolize group discussion or sometimes refrains from speaking when feedback is appropriate.

1 Mistakes personal strengths and attempts to take on unsuitable roles; dominates discussion or does not respond to requests for feedback.

Although different scales are used (e.g., some systems utilize a three point sale, some a six point scale) all systems identify some performance standard either implicitly or explicitly. For example, level three in the rubric above is the performance standard - that level of performance one would expect from students who were considered competent. Appendix E contains rubrics for the competencies and subcompetencies in this model.

The need for rubrics is clear from both assessment and instructional perspectives. From an assessment perspective rubrics are necessary to ensure that performance is assessed in a consistent way from rater to rater. From an instructional perspective rubrics are needed to provide students with guidance as to the demands of assessment tasks and the expectations of the teacher. As Loacker, Cromwell and O'Brien note: "We find that students at the start need very explicit criteria. They are trying to figure out what they are supposed to do and, in effect, they use the criteria as a recipe or set of directions to plot a performance." (1986, p. 51).

SECURED TASKS

Where multiple validations have the advantage of placing assessment in the hands of individual teachers and clearly linking assessment with instruction, they cannot match the standard of high reliability now achieved by more traditional forms of assessment. To approach such levels of reliability within a comprehensive assessment system, secured tasks are required. Where the authentic classroom tasks used for multiple validations are assessed by individual teachers and used within a regular classroom setting, secured tasks are assessed by groups of trained raters and given in controlled situations. Because they are designed to maximize reliability, secured tasks will commonly focus on no more than two of the competency areas. Indeed, secured tasks are frequently structured so that they emphasize the following:

- competency areas 1 and 2 while controlling for all others
- competency areas 3 while controlling for all others
- competency areas 4 while controlling for all others.

While it is possible to construct secured tasks for competency areas 4 and 5, the practice is not common. (Appendix F contains examples of secured tasks organized around the fourteen complex reasoning processes).

Although secured tasks might be administered by regular classroom teachers (assuming that the proper controls were utilized), they would be judged by a group of trained raters using the same rubrics as those employed with multiple validation tasks or, more preferably, with rubrics designed especially for the task. The use of trained raters with each task provides the opportunity to establish a high reliability. That is, with a small set of raters, precautions can be taken to ensure a uniform application of rubrics. This, of course, is the system used by the Educational Testing Service's Advanced Placement program.

The use of secured tasks, the assessments of which have high reliability, serves as a powerful "back-up" to multiple validations. That is, where the classroom teacher oriented multiple validations will, by definition, have a certain amount of unreliability, secured tasks can be highly reliable estimates of the same competencies.

PORTFOLIOS

Portfolios have received a great deal of attention in the past decade, particularly within the area of writing assessment (Belanoff & Dickson, 1991). The original metaphor for portfolio assessment was the artist's portfolio. Artists carry their completed, polished works in a portfolio that they show to prospective clients. In effect, the artist's portfolio is an attempt by the artist to put his/her best foot forward. Because of its similarity in terms of an emphasis on tangible products, writing is perfectly suited to portfolio assessment. Hence the field of writing instruction has seen the most extensive use of portfolio. It is important to note that within the writing process movement, portfolio use has evolved to a "working file" notion. For example, Tierney, Carter and Desai (1991) note that writing portfolios should include (among many other things):

- works in progress
- ideas for future products

However, as discussed in this document, portfolio assessment refers only to polished products that have been selected by the student and represent the student's best work.

Portfolios include physical evidence of all competency areas - even those that are not amenable to tangible products. For example, collaboration does not automatically result in a finished product. However, within her portfolio a student would be expected to provide evidence of her skill and effort at collaboration. This might be a signed statement by her classmates that she, in fact, is a good cooperative/collaborative worker. Additionally, a student might include evidence from outside of the classroom. For example, to illustrate her skill and effort at collaboration, the student might elicit a testimonial letter from her minister or scout leader and include it in her portfolio. For those competencies that do lend themselves to finished products, the student could select those products that best reflect her ability. For example, to illustrate her ability to produce quality products that communicate effectively, the student might include a videotaped documentary she had put together for an authentic classroom task chronicling the effects of water pollution in her community.

Student portfolios provide a unique opportunity for students to control and direct the information that will be used to assess them. Where multiple validations and secured tasks are initiated and evaluated by teachers and administrators, portfolios are generated by the student, preferably with the aid of a mentor.

THE CHANGING ROLE OF INSTRUCTION

The changes in assessment described in this document will have a profound effect on instruction. In this section we discuss two areas of change in instruction: 1) the shift to an outcomes orientation and 2) the use of practice.

An Outcomes Orientation

The types of change in assessment described in this model imply a change from a norm referenced system of instruction based on time to an outcomes oriented system based on performance. Specifically, in the current system students are expected to spend a certain amount of time in specified classes. This, of course, is a function of our organization around Carnegie units, the practice of which was initiated in 1895 (Pulliam, 1987). At the end of the allotted time, students are assessed using instruments designed to spread them out in a way that reflects a normal distribution.

Within an outcomes-based system, performance rather than time is the standard. That is, students must meet a certain level of performance regardless of how long or short a period of time this takes. (Block, 1985; Jones & Spady, 1985). If operationalized, this principle in and of itself would restructure schooling. Rather than be passed on from grade to grade or course to course whether or not specific knowledge or skill had been acquired, students would be held accountable for the acquisition of specific standards. This would add incentive for both students and teachers for increased effort in learning and instruction, respectively.

The Role of Practice

Within a norm referenced system, it is important to keep test information from students to ensure that some will do poorly. This is necessary to approximate a normal distribution of scores. However, within an outcomes-based system, allowing students to practice for assessment tasks is not only valid but encouraged. Specifically, there is a strong relationship between the secured tasks students will receive and the types of activities they experience in class. Students often practice the types of secured tasks they will take. For example, consider the following secured task:

> *Secured Task* (Students work individually and are given one hour to finish the task. They may use their notes and their textbooks. Their responses are reported in essay form.)
>
> How do diamond and zirconium compare in terms of their scarcity? What would happen in the marketplace if either should become scarce? For the two characteristics identified above describe how diamond and zirconium are similar and different.

In preparation for this, students might be asked to perform the following classroom task:

> *Authentic Classroom Task* (Students work in cooperative groups and take four class periods to complete the task. They report orally or in a panel discussion format.)
>
> Select one naturally occurring and one man-made substance for which a comparison between the two might be useful. Then select two or more characteristics on which to compare the two substances, such as problems that arise in production, or the differences in marketing and distribution, or the causes and effects of scarcity, etc. Finally, describe the ways in which the substances are alike or differ according to the area you've selected.

Assessment, then, can truly drive instruction in a manner that enhances learning. The utility of practicing secured tasks would create a curriculum of authentic classroom tasks that could be used as vehicles for multiple validation.

SUMMARY

The model presented in this document attempts to integrate the current research, theory and practice in assessment into a comprehensive system. Specifically, the model poses six categories of competencies that should be included in any comprehensive assessment system. These competencies are meant to be assessed in three basic ways, through 1) multiple validations, 2) secured tasks and 3) portfolios. Implicit in this model is the identification of world class standards within content areas identified as important at the local, state or national levels.

APPENDIX A

14 COMPLEX REASONING PROCESSES: DEFINITIONS

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COMPARISON

Comparison involves articulating the similarities and differences between two entities on specific characteristics.

CLASSIFICATION

Classification involves organizing entities into categories based on specific characteristics.

STRUCTURAL ANALYSIS

Structural Analysis involves describing in detail the top level or superordinate structure within information along with the supporting subordinate structures and their relationships.

SUPPORTED INDUCTION

Supported Induction involves creating a generalization from information explicit or implicit within the whole and then articulating that implicit or explicit information along with the reasoning leading to the generalization.

SUPPORTED DEDUCTION

Supported Deduction involves identifying a generalization implicit or explicit within information or an incident and then articulating the implicit or explicit consequences of that generalization.

ERROR ANALYSIS

Error Analysis involves identifying and articulating specific types of errors.

CONSTRUCTING SUPPORT

Constructing Support involves developing a well articulated argument for or against a specific claim.

EXTENDING

Extending involves identifying how the abstract pattern within one piece of information is similar to or different from the abstract pattern within another piece of information and supporting the reasoning leading to the perceived relationships.

DECISION MAKING

Decision-Making involves selecting among apparently equal alternatives.

INVESTIGATION

There are three basic types of investigation tasks:

Definitive Investigation: constructing a definition or detailed description for a concept for which such a definition or description is not readily available or accepted.

Historical Investigation: constructing an explanation for some past event for which an explanation is not readily available or accepted.

Projective Investigation: constructing a scenario for some future event or hypothetical past event for which a scenario is not readily available or accepted.

SYSTEMS ANALYSIS

Systems Analysis involves identifying and describing the internal structure of a system, its operation and how it interfaces with what lies outside the system.

PROBLEM SOLVING

Problem Solving involves developing, testing and evaluating a method or product for overcoming an obstacle or a constraint.

EXPERIMENTAL INQUIRY

Experimental Inquiry involves generating, testing and evaluating the effectiveness of the hypotheses generated to explain a phenomenon and then using those hypotheses to predict future events.

INVENTION

Invention involves developing a unique product or process which fulfills some articulated need.

APPENDIX B

14 COMPLEX REASONING PROCESSES: SUBCOMPETENCIES

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COMPARISON

Specific competencies involved:
a. specifying appropriate elements to be compared.
b. specifying appropriate characteristics on which the elements are compared.
c. accurately identifying the similarities and differences between elements on the identified characteristics.

CLASSIFICATION

Specific competencies involved:
a. specifying important elements to be classified.
b. specifying useful categories into which the elements will be sorted.
c. specifying important defining characteristics of the categories.
d. accurately sorting the identified elements into the categories.

STRUCTURAL ANALYSIS

Specific competencies involved:
a. accurately identifying and articulating the top level (main theme) information within the whole.
b. accurately identifying and articulating the supporting or subordinate structures (supporting details) to the top level information within the whole.
c. accurately identifying information not related to the main theme or its supporting detail.

SUPPORTED INDUCTION

Specific competencies involved:
a. identifying specific and important points or observations from which to make inductions.
b. accurately interpreting the information from which inductions are made.
c. making and articulating accurate conclusions from the selected points/observations.

SUPPORTED DEDUCTION

Specific competencies involved:
a. identifying and articulating an important or significant generalization implicit or explicit in the information.
b. accurately interpreting the generalization.

c. identifying and articulating logical consequences implied by the identified generalization.

ERROR ANALYSIS

Specific competencies involved:

a. identifying and articulating significant errors in information or in a process.
b. accurately describing the effects of the errors on the information or process in which it is identified.
c. accurately describing how to correct the errors.

CONSTRUCTING SUPPORT

Specific competencies involved:

a. accurately identifying a claim that requires support.
b. providing adequate or appropriate evidence for the claim.
c. adequately qualifying or restricting the claim.

EXTENDING

Specific competencies involved:

a. identifying information to be extended that is important and useful.
b. identifying a representative general or abstract form of the information.
c. accurately articulating the relationship between the abstract pattern and the second set of information.

DECISION MAKING

Specific competencies involved:

a. identifying appropriate and important alternatives to be considered.
b identifying important criteria used to assess the alternatives.
c. accurately identifying the extent to which each alternative possesses each criteria.
d. making a selection that adequately meets the decision criteria.

INVESTIGATION

The specific competencies common to all three types involves:

a. accurately identifying what is already known or agreed upon about:

  o the concept (definitive investigation).
  o the past event (historical investigation).
  o the future event (projective investigation).

b. identifying and explaining the confusion or contradiction about:
  - o the concept (definitive investigation).
  - o the past event (historical investigation).
  - o the future event (projective investigation).

c. developing and defending a plausible resolution to the confusion/contradiction about:

  - o the concept (definitive investigation)
  - o the past event (historical investigation)
  - o the future event (projective investigation)

SYSTEMS ANALYSIS

Specific competencies involved:
a. accurately identifying and describing the boundaries of the system.
b. accurately identifying and describing how the component parts interact.
c. accurately identifying and articulating how the system could break down.
d. accurately describing how the system interfaces the world outside it across the system boundaries.

PROBLEM SOLVING

Specific competencies involved:

a. accurately identifying constraints or obstacles in the way of achieving the desired outcome.
b. identifying viable and important alternative ways of overcoming the obstacle or the constraint.
c. selecting and adequately trying out alternatives.
d. if other alternatives were tried, accurately articulating the reasoning behind the order of their selection and the extent to which each overcame the obstacles of constraints.

EXPERIMENTAL INQUIRY

Specific competencies involved:

a. accurately explaining the phenomenon initially observed.
b. making a logical prediction based on the facts, concepts and principles underlying the explanation.
c. setting up and carrying out an activity or experiment that effectively tests the prediction.
d. effectively evaluating the results of the activity/experiment in terms of the original explanation.

INVENTION

Specific competencies involved:

a. identifying a process or product that will improve on or meet an unmet need.
b. identifying rigorous and important standards or criteria the invention will meet.
c. making necessary and important revisions in the process or product.
d. continually revising and polishing the product until it reaches a level of completeness consistent with the criteria/standards that were articulated.

APPENDIX C

Elementary Mathematics: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Select and use appropriate computation techniques and determine reasonableness of results

Model understanding of basic facts, algorithms and fractions

Model, compare, classify, draw and describe geometric figures

Use measurement related to length, capacity, weight, time and temperature

Collect, organize, construct, analyze and describe displays of data, including tables, charts and graphs

Recognize, describe, extend, analyze, create and apply patterns to represent and solve problems

Explore and investigate relationships among whole numbers, fractions, decimals and percents

Relate counting, grouping and place-value concepts as they apply to whole numbers, fractions, decimals, integers and rational numbers

Use concepts of chance

Elementary Science: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Identify problems and formulate hypotheses and test these experimentally

Make or choose a conclusion about the hypothesis and experiment based on the data collected and the observations made

Use the conclusion of an experiment to make predictions and inferences

Use the basic tools of scientific inquiry including comparing and contrasting information from a variety of information sources

Correctly use instruments which are integral to scientific experiment and observation such as microscopes, balances, scales, hand lens, thermometers, etc.

Elementary Geography: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Use direction, scale, legend/key and symbols on maps

Locate on a world map major land masses, water bodies, the U.S. and its neighbors

Compare one's own community with other communities

Compare rural, suburban and urban environments

Recognize how humans both help and hurt the environment

Describe how regions may be defined by cultural, physical or political reasons or by a combination of all of these

Describe ways in which people move themselves, natural resources, products and ideas across the earth

Elementary Social Science/History: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Explore and relate the concepts of tradition and change, unity and diversity, power and politics, and liberty and equality to the social sciences

Exhibit an awareness of contemporary issues, events, ideas and people through the critical reading and discussion of current news materials

Understand how societies are organized and people interact at the local, state, national and international levels

Examine past events, people and issues from multiple perspectives

Recognize the various political and economic systems under which people live

Understand the difference between primary and secondary sources and the difference between historical evidence and literary interpretations

Understand the roles, rights and responsibilities of living in a democratic society

Recognize the dignity of all people and seek justice by active, involved citizenship

Understand the contributions and importance of individuals who have made a significant difference in history

Elementary Language: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Use prior knowledge to employ a variety of strategies while reading, writing, listening and speaking

View literacy learning as a means to communicate and to understand one's own life

Consciously expand one's vocabulary employing strategies to deal with unknown words

Apply basic literacy skills of reading and writing

Respond to, expand, and interpret text, making connections to previous literacy experiences

View language as a tool for lifelong learning

Appreciate literature as a reflection of culture across time and place

Write using a variety of forms for different purposes and audiences

Elementary Arts: Benchmarks (Grade 4, Age 10)

The student will demonstrate the ability to:

Understand and be able to recognize the role of the arts and artists in our community

Be aware of other cultures through their arts, and how the arts can tell us about other historical periods

Know, understand and be able to apply simple techniques and the personal motivation necessary for expressing, creating and performing in dance, drama/theater, music and the visual arts

Engage in beginning experiences in all the arts

Analyze and make judgments about works of art using self-defined and group-established criteria

Think about and discuss questions concerning the meaning, nature and value of the arts; recognize that other studentsU criteria may be different but equally acceptable

Experience positive attitudes and values toward learning in the arts, toward him or herself, toward others, and their works of art

Middle School/Junior High Mathematics: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Apply a variety of estimation and mental computation strategies in problem situations involving whole numbers, fractions, decimals, integers and rational numbers

Use models to relate fractions to decimals and explore operations with fractions and decimals

Investigate and predict the results of combining, subdividing, changing and transforming geometric figures

Construct, understand and extend the attributes of area, volume and angle

Use experimentation, simulation and theoretical methods to determine and apply probabilities

Use rules, tables and graphs to interpret equations and inequalities, and to analyze and solve problems

Analyze functional relationships to explain how a change in one quantity results in a change in another

Represent and operate in situations which involve variable quantities with expressions, equations, inequalities and matrices

Apply ratios, proportions, percents, rates and other derived and indirect measurements

Middle School/Junior High Science: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Collect, record and organize data, and make a conclusion about the hypothesis of an experiment based on the data collected

Produce a written report based on scientific observations and conclusions made during a scientific investigation

Use the conclusion of an experiment to make predictions about further investigations

Use mathematics, measurements, computing and other tools of science by:

- creating and interpreting graphs, tables and diagrams
- measuring, understanding and converting in the metric system
- selecting proper equipment and instruments, and demonstrating the correct use of these to conduct experiments

Use scientific information by:

- distinguishing between fact, hypothesis and opinion
- identifying and recording main ideas from scientific textbooks and readings
- demonstrating the ability to develop an opinion about scientific issues and communicating and discussing these issues with others
- gathering and using appropriate resources for scientific investigations
- formulating conceptual models based on data and scientific knowledge

Middle School/Junior High Geography: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Work with latitude and longitude as a means of understanding absolute location, climate and time zones

Explain the where and why there of cultural and political sites

Use thematic maps to determine the level of development of countries or regions

Explain the geographic background of local, national and international events and issues using a variety of resources including print and electronic

Create and use maps, charts, graphs and tables to display and analyze data

Show that map projections distort global distances, directions, areas and shapes

Middle School/Junior High Social Science/History: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Compare and contrast the various political, economic and social systems under which people live

Develop an understanding of democratic institutions and civic competency through knowledge of and active involvement in political, social or economic issues

Know and intellectually understand the Declaration of Independence, the Constitution and the Bill of Rights, and the relationship of these documents to the student's life

Utilize and analyze historical evidence, and literary and artistic interpretations

Integrate the basic concepts of tradition and change, unity and diversity, power and politics, and liberty and equality to all the social science disciplines and to their lives

Critically analyze contemporary issues, events, ideas and people from an historical perspective which will allow for future projections

Apply knowledge of multiple perspectives and contributions of past civilizations to an understanding of cultural diffusion and contemporary life

Understand how societies have been and are organized in the western and non-western world and how people have interacted throughout history

Understand the contributions and importance of individuals who have made a significant difference in history

Perceive the interrelationship of history, the social sciences and the humanities

Examine and internalize the social, economic and political history of the United States through the Reconstruction of the South

Understand the evolution of American democracy; its ideas, institutions and practices from colonial times to the present

Middle School/Junior High Language: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Use experiences and backgrounds of self and others to generate ideas for writing in different styles for a variety of purposes and audiences

Learn and apply several strategies for drafting and revising while writing

Apply the conventions of writing while refining writing through editing

Prepare writing for a variety of audiences

Select texts to read accurately, making valid inferences and judging literature critically based on personal response

Set a purpose for reading; apply and extend reading techniques

Extend comprehension strategies for reading various texts

Confer with other readers and writers about their responses to and interpretation of texts

Learn about self and others through reflection on literature

Extend and apply strategies for selecting, learning and using new vocabulary

Use knowledge meaningfully from reading, writing, speaking and listening experiences

Extend literacy knowledge while using electronic media

Extend and apply strategies for developing listening and speaking skills

Extend and apply thinking and reasoning strategies to enhance reading, writing, listening and speaking

Middle School/Junior High Arts: Benchmarks (Grade 8, Age 14)

The student will demonstrate the ability to:

Understand and be able to recognize the role of the arts in our culture, and in other cultures throughout history

Know, understand and be able to apply the basic techniques and personal motivation necessary for expressing, creating and performing in dance, drama/theater, music and the visual arts

Begin to select an arts area of high interest or skill to choose for lifelong development based on in-depth experiences in all of the arts

Analyze and make judgments about works of art using one or more formal systems for criticism and the self-defined or the established criteria of a group

Formulate a personal philosophy of the arts and be able to debate issues concerning the meaning, nature and value of the arts; recognize that ideas about the arts are sometimes based in the culture of a society and often change over time

Develop positive attitudes and values toward learning in the arts, toward him or herself, toward others, and their works of art

Secondary Mathematics: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Use transformations, coordinates and geometric models to represent problem situations and deduce properties of figures

Identify and classify congruent and similar figures

Use a variety of algebraic methods to model real-world phenomena and analyze the effects of parameter changes on the graphs of functions

Make and evaluate inferences and convincing arguments by translating among tabular, symbolic and graphic representations of functions

Use appropriate statistics, including the concept of a random variable, to generate and interpret data, transforming it as necessary, to test hypotheses

Make predictions based on experimental or theoretical probabilities

Apply the real number system and its various subsystems and number theory concepts (e.g., primes, factors and multiples) to real-world and problem situations

Represent and solve problems using matrices to solve linear systems, linear programming and difference equations

Investigate problem situations which arise in connection with computer validation and the application of algorithms

Secondary Science: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Understand that science is based on experimentation and cannot completely answer all questions

Observe and collect scientific data and make logical inferences and predictions about natural phenomenon, and be able to assess the probable accuracy of their hypotheses

Understand the process of scientific inquiry by conducting an experiment and

- identifying problems and formulating hypotheses
- identifying control and experimental groups
- identifying independent and dependent variables
- collecting, recording and organizing data
- analyzing and synthesizing results
- interpreting results and developing conclusions which would give rise to further experiments

Make careful observations and prepare charts, graphs and tables of scientific data, and understand the value and importance of instrumentation and technology in the process

Understand the states of matter in static forms and make observations of matter in the dynamic processes of physical, chemical and biological change

Observe and analyze models of various scientific phenomenon related to matter, energy, force and motion and other natural phenomenon from the birth of stars to the behavior of cells

Apply scientific knowledge to make informed decisions that are personally, socially and environmentally responsible

Formulate conceptual models based on data and scientific knowledge, and discuss the usefulness and limitations of science and technology in advancing human welfare

Reason conceptually and recognize the difference between causal and correlational relationships

Secondary Geography: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Understand the significance of state and regional geography

Draw conclusions and make decisions from geographic data including atlases, charts, graphs, print and electronic media

Recognize the global patterns and processes that shape the environment, both physically and culturally (e.g. climate patterns, natural hazards, atmospheric and oceanic circulation systems, cultural diffusion, population, transportation and communication patterns

Assess the impacts that both the developed and the developing worlds have on the environment; devise and evaluate solutions to those environmental problems

Understand the interdependence of the world by:

- describing how an environmental change in one place can influence other places
- investigating the advantages of international trade
- giving examples of ways movement of ideas and knowledge between nations can help them
- explaining how a conflict in one region affects other regions

Illustrate how interdependence leads to issues of global significance (e.g., environmental pollution, economic indebtedness, arms control and political turmoil)

Select a site for a facility (such as a factory, waste disposal plant, hospital, day care center, ski resort, recreational complex, parking lot) and justify the site selection

Draw hypothetical maps showing how regional boundaries might change as a result of future population or political changes and discuss the implications

Secondary Social Science/History: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Analyze and synthesize his or her understanding of the basic documents of American democracy in a research paper

Understand democratic institutions and civic competency through community service projects, voting and political involvement

Make decisions based on historical evidence and literary and artistic interpretations

Understand and have empathy for the long struggle for human rights and human dignity

Understand producer, national and world economic problems from the perspectives of consumer, world citizen and decision maker

Evaluate the contributions and importance of individuals who have made a significant difference in history

Analyze the major forces affecting world and United States history from the prehistoric period to the present

Secondary Language: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Use prior knowledge to select the process and strategies for reading, writing, speaking and listening to extend communication and meaning in one's own life and community

Evaluate the effectiveness of his or her own language and the language of others

Appreciate diversity in literary traditions among nations and cultures

Extend and refine independent competency in interpreting, evaluating and comparing texts and literature

Develop and expand one's own writing style for use for a variety of purposes and audiences

Understand that language and literacy involve reading, writing and reflecting on various texts from multiple perspectives

Use both oral and written language to provide a means of insight into one's own life and the lives of others

Apply language competency as a lifelong skill for communication and expression as a functional and productive student and citizen

Advance knowledge of grammar, syntax and rhetoric for effective speaking and writing

Secondary Arts: Benchmarks (Grade 12, Age 18)

The student will demonstrate the ability to:

Know, understand and recognize the role of the arts in our culture and other cultures throughout history

Understand and be able to apply the techniques and the personal motivation necessary for expressing, creating and performing in dance, drama/theater, music and the visual arts

Perform or create works of art in a chosen area to a degree which will provide a vehicle for lifelong personal, creative expression

Analyze and make judgments about works of art using one or more formal systems of criticism and the self-defined or established criteria of a group

Possess a personal philosophy of the arts and be able to discuss the nature, meaning and value of the arts in different cultures and in their lives

Demonstrate positive attitudes and values toward learning in the arts, toward him- or herself, toward others, and their works of art

SOURCES

The American Association for the Advancement of Science (AAAS). (1989). Project 2061: Science for all Americans. Washington, D.C.: Author.

American Library Association Presidential Commission on Information Literacy. (1989). Final report. Chicago: American Library Association.

Arizona Department of Education. Arizona visual arts essential skills.

Bradley Commission on History in Schools. (1988). Building a history curriculum: Guidelines for teaching history in schools. Washington, D.C.: Educational Excellence Network.

California Department of Education. (1990). California visual and performing arts framework.

Council for Basic Education. (1991). Perspective, 4(1). Washington, D.C.: Author.

Costa, Arthur L. Thinking: How do we know students are getting better at it? Roeper Review, 6(4), pp. 197-202.

History-Social Science Curriculum Framework and Criteria Committee, California. (1988). The history-social science framework. Sacramento, CA: California State Department of Education.

Inhelder, Barbel, & Piaget, Jean. (1958). The growth of logical thinking from childhood to adolescence. NY: Basic Books.

Joint Committee on Geographic Education of the National Council for Geographic Education and the Association of American Geographers. (1984). Guidelines for geographic education: Elementary and secondary schools. Washington, D.C.: Author.

Minnesota Department of Education. (1974) Model learner outcomes for art education. Reston, VA: Author.

Music Educators National Conference. School music program: Description and standards. (1986). Reston, VA: Author.

National Center for Improving Science Education. (1989). Getting started in science: A blueprint for elementary school science education. Andover, MA: Author.

National Commission of Social Studies in the Schools. (1989). Charting a course: Social studies for the 21st century. Washington, D.C.: Author.

National Council of Teachers of English (NCTE). (1982). Essentials of English: A document for reflection and dialogue. Urbana, IL: NCTE.

National Council of Teachers of English (NCTE) and the Modern Language Association (MLA). (1987). The English Coalition Conference: Democracy through language, essentials of English. Urbana, IL: NCTE.

The National Council for Teachers of Mathematics (NCTM). (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

National Dance Association. Dance: Curricula and guidelines.

Philip, Dr. Frank S., Michigan State Board of Education. (1989). Michigan essential goals and objectives for arts education (K-12). Lansing, MI: Michigan State Board of Education.

Quigley, Charles N., Bahmueller, Charles F. (Eds.). (1991). Civitas: A framework for civic education. National Council for Social Studies, Bulletin No. 86. Calabasas, CA: Center for Civic Education.

Secretary's Commission on Achieving Necessary Skills. (1991). What work requires of schools. Washington D. C.: U. S. Department of Labor.

APPENDIX D

AUTHENTIC CLASSROOM TASKS

ELEMENTARY LEVEL

COMPARISON

(Students work in triads for a one week period of time, at the end of which they present their findings as an oral report. They also create a product to represent the affective impact of the two types of literature they pick.)

This year we have studied and read different types of literature - poems, adventure stories, tall tales, fables, historical novels and some others. Pick two types of literature and describe how they are similar and how they are different.

CLASSIFICATION

(Students are provided with an outline of a bar graph with the numbers 0 to 20 on the vertical axis and line drawings of solid shapes [sphere, cone, box, cylinder] on the horizontal axis. They work in cooperative groups for two class periods classifying objects. They then graph their results and provide a verbal explanation.)

This week we have been studying shapes. Now, let's see how many of these shapes we can find. Look around the classroom or at pictures in magazines and see how many things you can find that are like the shape or the graph you have been given. Color one [insert rebus of box] for each solid you found. Be able to explain why your graph turned out the way it did.

STRUCTURAL ANALYSIS

(Students work in pairs over a two-day period of time. At the end of the two-day period, students present their findings to the class orally using an overhead projector.)

Pick any number and write the word name for this number. Count the letters in the word name. Write the word name for that number. Continue this process until you can identify some obvious patterns. What is the main pattern? Explain why it happens. What are some other patterns? Explain them.

SUPPORTED INDUCTION

(Students work in cooperative groups for one week. At the end of that time they present their conclusions as a skit depicting the Ninja Turtles explaining their conclusions to their friends.)

Cowabunga, dude! You are a mutant Ninja turtle and have just peeked out of the sewer in our city for the first time. What can you conclude about the people in our city and the things that happen in our city?

SUPPORTED DEDUCTION

(Students work in cooperative groups for a two week period of time, at the end of which they present a skit and an explanation of the deductive logic of their system of clues.)

Develop the clues to a murder mystery that has at least three suspects. However, your clues must show that one suspect had to be the murderer.

ERROR ANALYSIS

(Students work in pairs or triads over a three week period of time, at the end of which they present their conclusions in videotape form. They also create and present some aesthetic product that symbolizes policework.)

What do policemen really do? Watch at least three television programs about policemen and describe some of the errors about policemen or policework in those shows.

CONSTRUCTING SUPPORT

(Over a two week period of time students work in pairs. At the end of that period of time they present their arguments orally with the aid of graphic organizers.)

We have been studying how great ideas have affected history. Develop an argument for or against the statement, "The pen is mightier than the sword." Use specific examples in your argument.

EXTENDING

(Students work cooperatively over a two week period of time. At the end of that time period, they present their findings orally along with the music and related items they have selected.)

Select a song we have been studying and then show how the basic pattern in that song is like the pattern in at least two other things that are not songs.

DECISION MAKING

(Students work in pairs over a two week period of time, at the end of which they present their decision as an oral report with accompanying pictures and artifacts.)

We have been studying many different parts of the country. Which one do you think would be the best place to live? Identify your selection and explain why it is the best place.

INVESTIGATION

Investigation (Definitive)

(Students work in triads for a three-day period of time. At the end of the time period, they present their conclusions in a chart along with a skit depicting the defining characteristics of the various types of plane figures.)

What are the different types of plane figures and how do you tell them apart? Draw pictures of the different kinds of plane figures and then develop a skit which portrays the key feature of each figure.

Investigation (Historical)

(Students work independently over a 1-week period of time. At the end of that time period, they present their findings as an oral report with accompanying visual aids.)

Identify a kind of automobile that was named after an actual person. What did the car look like when it was first introduced? If it is still being manufactured, what does it look like today?

Investigation (Projective)

(Students work in cooperative groups of four over a two-week period of time, at the end of which they present their findings as a videotaped report.)

Choose an invention and show how our lives would be different if it were never invented. Suggest other kinds of devices that might have been just as useful in its place.

SYSTEMS ANALYSIS

(Students work in triads for a two-week period of time at the end of which they make a presentation using diagrams and other visual aids.)

In 1982 Phillips and Sony produced the first audiodisc called the digital or compact disc. Describe how a compact disc is made and how it is able to produce sound. What are the parts and how do they work together? What happens to the whole system when different parts break down?

PROBLEM SOLVING

(Students work in cooperative groups for a two-week period of time, at the end of which they present their findings as a debate.)

Many people blame the Japanese for the decline of the manufacturing industry in the United States. Some Americans argue that if more people in this country would "Buy American" there would be less unemployment. However, many people say that the quality of American merchandise does not compare with the Japanese imports. Assume this is true. How could you increase the sale of American products with the constraint that it will take a long time -- at least ten years -- to increase the quality of American products?

EXPERIMENTAL INQUIRY

(Students work in cooperative groups over a three-week period to conduct interviews, interpret data, and draw conclusions. They present their findings as an oral report to the class.)

Conduct a poll in your group about who should win the election for President of the United States. Based on the findings from your group, make a prediction about how people in the community feel about the presidency. Then conduct interviews in the community about who should win. Report on the selection of your group and the findings based on the interviews from the community. Make sure you relate the findings from the community with your original prediction.

INVENTION

(Students work in pairs over a three-week period and present their inventions to the class along with a videotaped report.)

Invent a household appliance that performs a much-needed task. Explain how it works and draw a picture or make a model of what it looks like. Be sure to show the changes you made on your invention as you developed it.

AUTHENTIC CLASSROOM TASKS

MIDDLE SCHOOL AND JUNIOR HIGH LEVELS

COMPARISON

(Students work in cooperative groups over a two week period of time. During a third week, they present their findings as a dramatic enactment, a journal or an oral presentation.)

Slavery or bondage has been a way of life in many different societies throughout history. Choose two societies where slavery or bondage has been practiced and imagine that you lived in each of these societies. Compare what it is like to live in each society on such factors as food, clothing, education, work and laws you have to obey.

CLASSIFICATION

(Students work in teams for two weeks. Their finished product is a chart and an oral presentation of their findings.)

Choose and examine a small area of ground (urban or prairie) and make up a classification system that illustrates how the ground is being used by man, plants, and animals. For example, animals may use the land for shelter, reproduction and food gathering, man may use the land for recreation, creating green space, trash dumping, etc. Describe your categories and the information you placed in each category. Make a chart that illustrates your categories and be prepared to explain it.

STRUCTURAL ANALYSIS

(Students work collaboratively over two or three class periods. Their final products are a picture or cartoon with oral or audiotaped presentations.)

Select a painting that is based on a familiar story or historical event. Familiarize yourself with the story or event and then examine the painting and analyze the artist's depiction of the main theme. Next, create a picture or cartoon of your own that depicts the main theme of the story. Finally, describe how the picture you selected and the picture/cartoon you created both depict the story.

SUPPORTED INDUCTION

(Students work in cooperative groups for three to four weeks, depending on accessibility of museums, libraries, etc.)

Historians and archaeologist work as detectives by drawing conclusions from evidence they find to try and reconstruct the past. Select several artifacts from a specific period in history (primary sources only) and, using only those artifacts, draw your own conclusions about the society and culture of that people. Explain your conclusions and describe how you came to them. Along with an oral report, you should use a dramatic presentation or a videotaped enactment of your conclusions about the society.

SUPPORTED DEDUCTION

(Students work independently or in small groups over a three week period of time, at the end of which they present their findings in a panel discussion or a videotaped report.)

"An ounce of prevention is worth a pound of cure" is an expression that can be applied to disease prevention. Assuming this is true, what conclusions can you draw? Illustrate each conclusion and provide examples.

ERROR ANALYSIS

(The task is presented at the beginning of the semester. Throughout the semester students work on the project in cooperative groups. At the end of the semester, they present their findings at a "trial".)

Throughout Medieval history and the Middle Ages, people, in their attempt to understand and explain natural phenomena, held many beliefs that seem strange or illogical to us today. For example, in Medieval times, people believed that you could tell if someone was a witch by their reaction to being dunked in a pool of water. Choose either a European or Asian society and identify some practice they have that is based on errors in reasoning. Describe these errors and explain where you obtained your information and how you came to your conclusions.

CONSTRUCTING SUPPORT

(During a one week period of time, students work in small groups and present their work as a debate or dramatic presentation.)

Select an issue that caused great debate in Colonial or Revolutionary America and take one side of the issue. Construct an argument to support your position and describe other positions. Provide evidence to support your argument but also describe and discuss the limitations and weaknesses in your position.

EXTENDING

(Students work in pairs for a two-week period of time. They then present their findings as a written report along with diagrams, charts and tables.)

Select a group of animals and identify some general rules the animals in that group follow. For example, identify how a leader is determined or how the animals share food. Then describe how the things you discovered about the animal group you picked are also found in some human groups.

DECISION MAKING

(Students work independently or in groups over a two-week period of time. At the end of the time, they present their decisions as an oral presentation to the class who represent the people affected by their decisions.)

Since the Revolutionary war, many important people have made decisions that have shaped our country. Select a figure who was instrumental in making a decision that altered the course of U.S. History. Put yourself in the place of that person and identify the alternatives the person was probably considering and the reason the person made the decision he did. You should be able to explain why the alternative you have selected is the best one.

INVESTIGATION

Investigation (Definitive)

(Students work in small groups over a three week period of time, at the end of which they present their findings as: a panel discussion, a videotaped presentation or a dramatic presentation.)

Identify an amendment to the Constitution that has caused controversy or confusion. Tell what is known or agreed upon about this amendment and explain where the confusion or contradiction exists. What do you think is the intent of this amendment and how could this amendment be reworded to reflect your views and clear up the confusion?

Investigation (Historical)

(Students work independently over a two week period of time. At the end of that time period they present their findings as an oral report with accompanying charts or graphs.)

Identify some mystery about a past civilization or group of people and try to solve the mystery. Make sure you describe solutions other people have proposed and show why your solution is the best.

Investigation (Projective)

(Students work in cooperative groups over a three week period of time, at the end of which they present their findings as a videotaped report.)

Select some source of energy and show how our lives would be different if it were absent. Identify some areas where people disagree about the use of this resource and explain the different viewpoints.

SYSTEMS ANALYSIS

(Students work in cooperative groups for two weeks. At the end of that time they present a detailed systems chart and explain their finding orally or as an audiotaped presentation.)

Choose an animal that is at the top of the food chain in the area where it lives. Map out the various items in the food chain for that animal. Also describe the natural changes that can occur within that food chain. Finally, discuss changes in the system that might occur because of outside factors.

PROBLEM SOLVING

(Students work in small groups for two weeks and present their problem and solution to a "citizens board" of other students. They have to be prepared to answer questions and defend their choice of alternatives.)

Many times, because of urban development, human encroachment or overgrazing, animals have to be killed or relocated. Choose an example of this kind of problem, examine the alternatives and identify ways to relocate the animals safely to another area without killing them. Choose one alternative and explain why it is best.

EXPERIMENTAL INQUIRY

(Students work in pairs over a one-week period. They present their data in a chart and summarize their conclusions in a written report.)

Geographers tell us that the earth has more water than land. Conduct your own experiment using a globe to determine how much of the earth is water and how much is land. First, make a guess by simply looking at the globe. Then, spin the globe and have your partner point to a spot on the globe without looking. Did you point to water or land? Keep doing this and record your results in a chart. How were your results converted to fractions? Do your results support the estimate? Explain.

INVENTION

(Students work collaboratively in small groups for two weeks. They then display their findings using diagrams and written descriptions.)

Human hair can be used to measure humidity. When the air is moist, hair expands. When the air is dry, hair shrinks. The change in length and humidity is measured using an instrument called a hair hygrometer. Invent an instrument that can be used to measure sunshine.

AUTHENTIC CLASSROOM TASKS

HIGH SCHOOL LEVEL

COMPARISON

(Students work in cooperative groups and take four class periods to complete the task. They report orally or in a panel discussion format).

Select one naturally occurring and one man-made substance for which a comparison between the two might be useful. Then select two or more characteristics on which to compare the two substances, such as problems that arise in production, or the differences in marketing and distribution, or the causes and effects of scarcity, etc. Finally, describe the ways in which the substances are alike or differ according to the area you've selected.

CLASSIFICATION

(Students work in cooperative groups for two weeks. At the end of that time they must turn in a written report with a model or map depicting their categories).

Categories of regions can be made up of almost anything, depending upon the elements you use to create them -- people, land, automotive supply stores. Select a variety of elements that will allow you to distinguish one category from another. For example, you could decide that the presence of one school, one church, and a gas station and convenience store comprise "a loose social neighborhood". Likewise, you could decide that an area with a ratio of three gas stations to one school may qualify as a business neighborhood, and a region with the reverse ratio (three schools to one gas station) could be described as a "residential neighborhood". Make sure you have enough combinations to provide you with at least five categories. Finally, select an area within the greater metropolitan area and identify at least one example of each category you have established. Also explain why your categories are useful ways of thinking about regions.

STRUCTURAL ANALYSIS

(Students work independently over three class periods. They report their answers in essay form).

Select an essay that strikes you as being well-organized and concise. Describe, in outline form, how the main idea is presented and what ideas are used to support the central idea. Include any subtopics and their support. Also identify stated information not related to the main theme or its supporting details.

SUPPORTED INDUCTION

(Students work in pairs over a two week period of time. At the end of that time they present their findings either orally or as a videotaped presentation).

Observations of events in nature have often produced great ideas, like Darwin's theory of natural selection. Select a living thing which you can observe easily and about which you can note events and characteristics. What generalizations can you make about the observations you have made? Describe the steps you took in coming to your conclusions.

SUPPORTED DEDUCTION

(Students work independently over a week period of time. At the end of that time they present their findings using a dramatic simulation or a written report).

Find and describe a principle that is explicit or implicit in the way that some legislative sessions are conducted. Specify the consequences of this principle by describing specific incidents that can be explained in terms of the principle or can be shown to be a clear illustration of the principle.

ERROR ANALYSIS

(Students are given one week to work in cooperative groups on the project. At the end of the period they make an oral presentation along with graphic representations supporting their conclusions).

Select a one-page print advertisement that seems to you to be misleading in some or all of its claims. Describe the kinds of errors you find, and what erroneous conclusions might be made by someone who is not aware of the errors. Explain how the advertiser could have presented this information so that it was not misleading. Could the advertiser have made the same point legitimately, given the right evidence to back it up?

CONSTRUCTING SUPPORT

(Students work independently over a two week period of time. At the end of that time they present their findings in oral or written form).

Find a commonly held belief about health or sickness ('feed a cold, starve a fever', for example) and then construct an argument for or against. Be sure to qualify your argument by stating its limitations and its underlying assumptions.

EXTENDING

(Students work on the task in pairs over a three class period interval of time. At the end of that time they present their findings in video documentary form).

Identify the generic elements or basic elements in the war in Vietnam. Then, identify another situation that has nothing to do with wars between nations and describe how that situation fits the basic elements you have identified.

DECISION MAKING

(Students work independently over a week's period of time. At the end of the week they make their presentations in oral or written form).

Select an action by an influential person within the fifteenth or sixteenth centuries that had important consequences for world history. Determine the characteristics of the decision that had to have been made by this person before such an action was taken. What alternative choices were available to this person when he or she made the decision? Determine what goals motivated the person in making his or her decision, and what criteria this person was likely to have applied in making his or her decision. What were the possible trade-offs in selecting one alternative over another? What were the risks, what were the rewards, and how would either be measured? Without benefit of hindsight, would you have made the same choice? Explain why or why not.

INVESTIGATION

Investigation (Definitive) (Students work in cooperative groups for a period of two weeks. At the end of that period of time they present their findings in a panel discussion format).

The renaissance was so called because it was considered to be the classical age reborn. Select any era of history that has gained a label of some kind ('Dark Ages', 'Age of Discovery', etc). and determine what it was that causes people to characterize the era as they do. Describe those aspects of the age that clearly don't live up to the label, and those aspects of the era that are completely obscured by the label. Also, decide whether, given the contradictions, the label used is valuable, or whether it is so misleading that another name should be assigned to the era.

Investigation (Historical) (Students work in pairs over a week's period of time. At the end of that time period they present their findings in written form).

What happened to the Dinosaurs? There are competing theories as to why dinosaurs became extinct. Determine what aspects of this event all theories agree upon. What do they all take into account, what is similar among the conclusions? Describe the competing theories in detail and their points of disagreement. Weigh the arguments and determine which seems the more reasonable, or propose a resolution of your own.

Investigation (Projective) (Students work independently over a week. At the end of that time period they present their findings in writing).

The notion that some countries are more 'developed' than others implies that one country's future may be understood as, in part, the re-enactment of another country's past. Select some aspect of development for which this might hold true (cultural development, military development, spiritual development, etc.). Working within the aspect of development you have selected, describe those changes within a developing country that you believe you can predict with some confidence. Identify those areas that would be least predictable. Finally, describe the ways in which the aspect of development you have selected can be better understood from the perspective of 'more developed' countries, and in what ways that perspective can be misleading.

SYSTEMS ANALYSIS

(Students work independently for a week's period of time. At the end of that time period they present their findings in writing, orally, in audiotape form or in videotape form).

Select an information system and determine whether the structure of the system is best described as componential or hierarchical, or a combination of the two. Delineate the boundaries of the system. Also, identify the type of errors that can creep into information as it is transmitted, or during storage and subsequent retrieval within the system. How does the system use negative feedback to correct errors? Can the system use feedforward to eliminate possible sources of error? What kinds of effects would a breakdown in part of the system have on the character of the information? How could a complete system failure be detected? Describe the interface of the system to the world outside it. Where and how does the information change at the point that it is taken up by another system?

PROBLEM SOLVING

(Students work in pairs over a week's period of time. At the end of that time period students present their findings in written form).

Create an addressing scheme (that is, a means for delivering mail) but you cannot use numbers in any way. Determine how you will test the efficiency of your system. List at least two possible ways of accomplishing the overall goal, then select one alternative and defend your selection after describing in depth what a section of addresses would be like without your scheme.

EXPERIMENTAL INQUIRY

(Students work individually for a two week period of time. At the end of that time period students present their findings orally along with a demonstration).

Identify something of interest you've noticed while riding in elevators. Explain this phenomenon using accepted principles. Based on your understanding of the principles involved, make a prediction that can be tested. Then, set up an experiment that will test your prediction and help explain the principles you've discovered. Finally, describe whether your experiment proved or disproved your hypothesis, and whether the principles you've described still hold true.

INVENTION

(Students work in cooperative groups over a three-week period to develop their own number system. At the end of this time they present their system using diagrams, charts, and an oral report).

Suppose you could travel back in time to ancient civilizations. The Ancient Egyptians developed a base-ten system that used symbols to represent powers of ten. You found some written on stone tablets and noticed that their number system did not allow for addition and subtraction. Invent a system using symbols that will compensate for this ancient number system. Develop sketches of the symbols and illustrate how the system works. Redesign any symbols that do not result in the correct sum or product. What limitations does you number system have?

APPENDIX E

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Generalized Rubrics for Declarative Knowledge

Does the student understand the important facts, concepts and principles?

Level 4:

The student demonstrates a thorough knowledge of essential facts, concepts and principles relative to the topic and provides new insights into some aspect of the topic.

Level 3:

The student has a good grasp of the facts, concepts and principles important to the topic.

Level 2:

The student has an incomplete grasp of the facts, concepts and principles important for the topic.

Level 1:

The student has severe misconceptions of the basic facts, concepts and principles important to the topic.

Generalized Rubrics for Procedural Knowledge

Does the student implement the processes or skills that are important to the task?

Level 4:

The student demonstrates a high level of proficiency in the use of processes and skills important to the task.

Level 3:

The student commits no major errors in implementing the processes or skills that are important to the task.

Level 2:

The student makes a number of errors in using the processes or skills important to the task, but can complete a rough approximation of the processes or skills.

Level 1:

The student makes many mistakes, and cannot completely use the processes or skills important to the task.

Generalized Rubrics for Comparison Tasks

a. Did the student select appropriate items/elements to be compared?

Level 4:
The student selects items that are very well suited for addressing the objective outlined in the task description, and that show original or creative thinking.

Level 3:
The student selects items that provide a means for successfully addressing the objective outlined in the task description.

Level 2:
The student selects items that satisfy the basic requirements of the task, but create some difficulties for executing the task.

Level 1:
The student selects items that are inappropriate or that create insurmountable problems for the accomplishment of the task objective.

b. Did the student select appropriate characteristics on which to compare the selected elements/items?

Level 4:
The student selects characteristics that encompass the most essential aspects of the items that are to be compared. In addition, the student may select characteristics that are intriguing or present some challenge.

Level 3:
The student selects characteristics that provide a vehicle for meaningful comparison of the items, and that address the question posed by the task.

Level 2:
The student selects characteristics that provide for a partial comparison of the items and may include some characteristics that are extraneous.

Level 1:
The student selects characteristics that are trivial, or do not address the issue presented in the task, or selects characteristics on which the items cannot be compared.

c. Was the student accurate in her assessment of the extent to which the identified elements/items possess or do not possess the identified characteristics?

Level 4:
On the selected characteristics, the student accurately assesses all identified similarities and differences for each element. Additionally, the student volunteers inferences from the comparison that were not explicitly requested in the task description.

Level 3:

On the selected characteristics and with no significant errors, the student accurately treats the most important similarities and differences for each element.

Level 2:

The student makes some important errors in identifying to what extent the items or elements possess the identified characteristics.

Level 1:

The student makes many significant errors in the assessing the characteristics of the items or elements.

Generalized Rubrics for Classification Tasks

a. Were the elements/items identified for classification important to the topic?

Level 4:
The student clearly specifies the elements to be classified, and selects items that are not trivial and that present some interesting challenge in classification.

Level 3:
The student selects elements for classification that are important for the subject area, and present some challenge in classification.

Level 2:
The student selects items that are of low importance, or may present little more than a routine sorting problem.

Level 1:
The student selects trivial items and the items possess no qualities that allow for any but self-evident classification methods.

b. Were the categories the student selected to organize the elements/items useful and important?

Level 4:
The student creates categories that provide a means for discussing the significant properties of the items. The categories provide a useful way of looking at the information at an unusual level of depth.

Level 3:
The student selects categories that provide a means for discussing the properties of the items in greater detail, and that focus on the significant characteristics of the items.

Level 2:
The student creates categories that provide sufficient means for analysis but might not include all characteristics of the items that are important.

Level 1:
The student creates categories that have no explanatory power and address only trivial aspects of the items.

c. Were the defining characteristics of the categories important and useful?

Level 4:
The student provides a clear and complete specification of the defining characteristics of each category. In addition, the student describes the defining characteristics in such a way as to provide a unique or unusual way of looking at the elements.

Level 3:
The student clearly specifies the defining characteristics of the categories and addresses any questions of overlap in characteristics.

Level 2:
The student describes the defining characteristics in a way that results in some overlap or confusion between categories, or the student describes characteristics that do not appear to be readily acceptable ways of defining the selected category or categories.

Level 1:
The student defines characteristics that are not suitable for the categories selected and do not contribute to usefulness of the classification.

d. Did the student accurately assess the extent to which each element/item possesses each defining characteristic?

Level 4:
The student correctly assigns each of the elements into the selected categories and describes the extent to which each element has the attributes ascribed to the categories. Additionally, the student describes insights that occurred during the sorting process.

Level 3:
The student correctly assigns each of the elements into the selected categories and when appropriate, the student describes the extent to which each element has the attributes ascribed to the categories.

Level 2:
The student makes some errors in assigning elements to their appropriate categories, or the student does not describe to what extent each element has the attributes of the category, when it is clearly appropriate for the task.

Level 1:
The student makes frequent and significant errors in assigning elements to categories and does not show how the elements have the characteristics of their assigned categories.

Generalized Rubrics for Structural Analysis Tasks

a. Was the student accurate in her identification of the top level of information or main theme?

Level 4:
The student articulates the main theme or dominant pattern within the work and describes the top level of information in depth. In addition, the student provides a perspective on the theme that allows a deeper analysis of the work.

Level 3:
The student clearly and correctly identifies the main theme or dominant pattern within the work and describes the top level of information in detail.

Level 2:
The student either mistakes an important sub-theme or sub-pattern for the top level information but clearly articulates the details of that sub-theme/pattern, or the student correctly identifies the top level information of the work but does not provide a complete discussion of the theme.

Level 1:
The student misidentifies the top level information of the material and does not provide any elaboration of the information he or she has identified.

b. Did the student accurately identify the structures subordinate to the top level information?

Level 4:
The student clearly identifies and describes the subordinate structures of the work and how they relate to the top level of information. The description provides a new and accurate way of understanding the structure of the work.

Level 3:
The student identifies elements and/or structures that are subsidiary to the top level information. The student makes clear how those aspects contribute to top level information or support it.

Level 2:
The student identifies the most essential elements that support the top level information but does not make clear how they work, or the student misidentifies some elements as supporting which may not be, but attempts to show how these elements support the top level information.

Level 1:
The student fails to identify important elements or structures that support the top level information and does not attempt to explain how the elements selected contribute to the main idea.

c. Did the student accurately identify information not related to the top level information or its supporting structures?

Level 4:
The student correctly identifies all information that is not related to the top level information or its supporting structures. In addition, the student interprets the role this information plays within the work as a whole.

Level 3:
The student correctly identifies information that is not related to the top level or its supporting information. The student might not identify all unrelated information.

Level 2:
The student identifies information that is not related to the top level structure, but may include some items that are supporting structures. If no information is unrelated, the student might not recognize this.

Level 1:
The student does not recognize unrelated information or misidentifies the top level information or a supporting structure as information that is unrelated to the whole.

Generalized Rubrics for Supported Induction Tasks

a. Were the elements (specific pieces of information) from which the student made inductions important to the general topic about which inductions were made?

Level 4:
The student clearly and accurately identifies all relevant observations or elements from which inductions are made. The student's selection of the information reflects creative insight and a careful observation of the area of concern.

Level 3:
The student specifies all relevant observations or elements from which inductions are made. The student selects observations or elements that are important to the general topic, and reflect a generally accurate interpretation of the information.

Level 2:
The student might include observations that are not important for the inferences, or the student might not accurately identify the observations from which the induction(s) could be made.

Level 1:
None of the student's observations are important nor do they directly relate to the inductions that are formulated.

b. Did the student make accurate interpretations of the information from which inductions were made? (e.g., Did the student understand the information or premises from which the inductions were made?)

Level 4:
The student provides inferences that illustrate insight into the information from which the inferences were made. The inferences reflect a study of or a familiarity with the particulars of the topic.

Level 3:
The student articulates inferences from the selected information. With few exceptions, the inferences are valid and say something important about the topic area.

Level 2:
The student draws inferences from a misunderstanding of the subject matter.

Level 1:
The student misinterprets the information when drawing inferences. The student makes inferences that have no bearing on the area, or are patently illogical.

c. Did the conclusions (inductions) drawn by the student naturally follow from the specific pieces of information used to draw the conclusions?

Level 4:
The student draws conclusions that reflect clear and logical links between the elements and the inferences drawn from them. The rationale for the inferences shows a thoughtful and accurate attention to the process of induction.

Level 3:
The student, with few errors, presents conclusions that follow logically from the observations or elements selected.

Level 2:
Some of the student's inferences reflect erroneous assumptions about what conclusions can be drawn from the observations.

Level 1:
The student draws many erroneous conclusions from the evidence and cannot satisfactorily describe the rationale behind his or her conclusions

Generalized Rubrics for Supported Deduction Tasks

a. Did the student base her deduction on an important or useful generalizations or principles governing the situation?

Level 4:
The basis of the student's deduction relies upon information that is significant in the topic material. The student's selection of a principle shows extreme insight into the topic.

Level 3:
The student selects important generalizations or principles on which to base a deduction. The generalizations contribute to the understanding of the material being studied.

Level 2:
The student provides generalizations that generally relate to the information available but the generalization might not have significant explanatory power.

Level 1:
The student offers a generalization that does not have significant bearing on the material and will not contribute to the understanding of the subject.

b. Was the student accurate in his or her interpretation of the generalization or principle?

Level 4:
The student's understanding of the generalization or principle is not only accurate but provides a unique perspective on the topic.

Level 3:
The student's understanding of the generalization or principle is accurate and contributes to an understanding of the topic

Level 2:
The student's interpretation of the generalization or principle is not accurate.

Level 1:
The student is clearly incorrect in his or her interpretation of the generalizations or principles.

c. Were the conclusions drawn by the student logical consequences of the identified generalization or principle?

Level 4:
The student draws accurate conclusions implied by the generalization or principle. The student also recognizes more subtle inferences that could have important effects on the subject area.

Level 3:

The student, with few errors, accurately identifies the inferences from the generalizations or principles. The consequences relate closely to the subject area and are worthwhile subjects for discussion.

Level 2:

The student accounts for important consequences of the generalizations, but identifies consequences that may not be germane to the area; or, the student makes logical errors in drawing conclusions.

Level 1:

The student identifies consequences that have little significance and are not germane to the area under analysis or do not make logical sense.

Generalized Rubrics for Error-Analysis Tasks

a. Did the student select important or critical errors in information or process?

Level 4:
The student accurately identifies all errors in the information or process under study. The student makes clear why the items identified are errors. Additionally, the student identifies subtle but consequential errors that are difficult to recognize.

Level 3:
The student accurately identifies all critical errors in the material under study and makes clear why the items identified are errors.

Level 2:
The student fails to recognize some important errors or the student identifies some items that are not truly errors.

Level 1:
The student recognizes only insignificant errors or mistakes valid items for errors.

b. Was the student accurate in her analysis of the manner and extent to which the errors affect the information or process within which they exist?

Level 4:
The student provides an accurate analysis of the consequences of the error. The student provides a complete description of the ramifications of the error beyond the most obvious levels of impact.

Level 3:
The student provides a good analysis of the effects of the errors on the process, omitting few details.

Level 2:
The student describes the effects that errors have on the information or process, but omits some important consequences; or, the student does not accurately describe all the effects of the errors.

Level 1:
The student does not correctly assess the effects that errors have on the information or process or describes effects that do not exist.

c. Was the student's description about how to correct the errors valid?

Level 4:
The student provides a highly thoughtful or creative approach for correcting the errors.

Level 3:

The student provides a workable way of correcting the errors. The response addresses the major concerns that arise because of the error.

Level 2:

The student provides an approach for correcting the errors. The approach addresses the major errors, while it might not be the best or most appropriate response to the situation.

Level 1:

The student does not provide a satisfactory description of how to correct the errors.

Generalized Rubrics for Constructing Support Tasks

a. Was the student accurate in his identification of information that needs support versus information that does not need support?

Level 4:
The student accurately identifies a claim that requires support. The identified claim has been mistaken by many others for a fact that requires no support.

Level 3:
The student accurately identifies a claim that requires support and does not confuse the claim with any other information.

Level 2:
The student identifies information that requires support but might mistakenly include other aspects of the information that do not require support.

Level 1:
The student identifies information that does not require additional support and fails to identify a claim that should have support.

b. Was the student's claim supported by a sufficient amount and appropriate types of information?

Level 4:
The student presents a clear and accurate treatment of all available evidence that addresses the central point of the claim. In addition, the student considers what evidence is missing, and how it should affect an evaluation of the claim.

Level 3:
The student, with no major errors, treats all relevant evidence that should be used to support the claim.

Level 2:
The student's argument provides evidence for the claim, but may not address all necessary aspects of a convincing argument.

Level 1:
The student fails to provide convincing evidence for the claim.

c. Was the student accurate in her description of the limitations of the claim and the support provided?

Level 4:
The student provides careful and reasoned qualifications for the claim in such a way that the argument provides a unique perspective on the claim.

Level 3:

The student provides qualifications of the claim as supported by the evidence available. The student's qualifications result in a well-defended claim.

Level 2:

The student qualifies or restricts the claim, but does not adequately address the limitations.

Level 1:

The student does not address the limitation of his or her argument.

Generalized Rubrics for Extending Tasks

a. To what extent was the information identified from the original source important and useful as a subject for the abstraction process?

Level 4:
The student identifies information that provides a rich source of material for the process of abstraction. The selected information presents a particular and worthwhile challenge for abstracting a pattern.

Level 3:
The student identifies information that is not trivial. The information selected also has properties that lend themselves to the abstraction process.

Level 2:
The student identifies information that does not appear important but can still be used to provide a pattern that can be used in the abstraction process.

Level 1:
The student identifies information that is trivial and cannot be described in terms that would be useful to the abstraction process

b. Did the abstract pattern the student identified represent the pattern of important information from the literal source?

Level 4:
The student creates an abstract pattern that provides an unusual or provocative insight into the information under study. The pattern furnishes the means for seeing other material with a unique understanding.

Level 3:
The student constructs an abstract pattern that accurately represents the information from which it came.

Level 2:
The student creates an abstract pattern that may not be a completely accurate representation of the information from which it was drawn but the abstract pattern does focus on the most important elements.

Level 1:
The student did not create an abstract pattern that accurately represents the information selected from the original source.

c. To what extent did the related information contain the key characteristics of the abstract pattern?

Level 4:
The student demonstrates creativity in the selection of another set of information that contains a similar abstract form. The second set of information is important and provides a very good subject for analysis.

Level 3:
The student correctly identifies a second set of information that contains the essential characteristics of the abstract form. The second set of information provides a worthwhile subject for study.

Level 2:
The student identifies information that does not provide a perfect match with the abstract characteristics, but has some similarities; or the information selected has so similar a pattern that the process of abstraction, while accurate or complete, does not provide a profitable subject for analysis.

Level 1:
The student selects information that does not conform in any way to the pattern identified.

Generalized Rubrics for Decision-Making Tasks

a. Did the student select appropriate and important alternatives to be considered?

Level 4:
The alternatives presented are clearly articulated, appropriate to the task, and present a meaningful decision-making challenge.

Level 3:
The student clearly identifies alternatives that are appropriate to the task and that present a genuine decision making task.

Level 2:
The student does not present clear alternatives, or selects alternatives that are not completely appropriate to the task.

Level 1:
The student selects alternatives that do not address the real issue and present no worthwhile challenge.

b. Did the student select important and appropriate criteria with which to assess the identified alternatives? Was the student accurate in her assessment of how important the identified criteria are to the decision?

Level 4:
The student clearly and completely identifies the criteria by which the identified alternatives will be assessed. The criteria are presented in detail and reflect an unusually thorough understanding and concern for the ramifications of the decision.

Level 3:
The student clearly identifies the criteria by which the identified alternatives will be assessed. With no significant exceptions, the criteria are appropriate to the alternatives and important to the decision task.

Level 2:
The student correctly identifies the principle criteria by which the identified alternatives will be assessed. Some criteria might be omitted, or included criteria might not be important factors for consideration or entirely appropriate for the decision task.

Level 1:
The student does not specify any criteria appropriate for the selected alternatives or of importance to the decision.

c. Was the student accurate in her assessment of the extent to which the alternatives possess the identified characteristics?

Level 4:
The student provides a thorough, fully developed assessment of each alternative based upon the criteria. In addition, the student also provides comparison and contrast of the alternatives according to the extent each meet the criteria.

Level 3:
The student presents an accurate assessment of the extent to which the alternatives possess the identified criteria.

Level 2:
The student's assessment of the alternatives does not completely address all the criteria for evaluation; or, the student applies all appropriate criteria to the alternatives but is not completely accurate in assessing how well the criteria have been met.

Level 1:
The student does not use all necessary criteria for evaluating the decision alternatives. The criteria the student uses are incorrectly matched to the alternatives.

d. Did the final selection adequately meet decision criteria and answer the initial decision question?

Level 4:
The student selects an alternative consistent with its rating on the criteria. The selection represents a well-supported answer to the initial decision question. In addition, the student provides a useful discussion of problems that arose during the selection process.

Level 3:
The student successfully answers the decision question by selecting an alternative that meets or exceeds established criteria.

Level 2:
The students selects an alternative that does not entirely conform to the student's assessment of the alternatives.

Level 1:
The student makes a selection that does not appear reasonable, or cannot be justified by the student's evaluation of the alternatives.

Generalized Rubrics for Investigation Tasks

a. Was the student accurate and complete in her assessment of what is already known or accepted about:

- the concept (definitive investigation).
- the past event (historical investigation).
- the hypothetical event (projective investigation).

Level 4:
The student presents a thorough and correct account of what is already known. In addition, the student supplies information that may not commonly be known but that has some impact on the topic being studied.

Level 3:
The student presents accurate information, with no important omissions, on what is already known or agreed upon the salient points of the topic.

Level 2:
The student presents information on what is already known or agreed upon the salient points of the topic or event. The information may not be complete in all particulars, or the student might introduce some inaccuracies.

Level 1:
The student presents little or no accurate information on what is already known or agreed upon the salient points of the topic.

b. Was the student accurate and complete in her assessment of a confusion or contradiction about:

- the concept (definitive investigation).
- the past event (historical investigation).
- the hypothetical event (projective investigation).

Level 4:
The student correctly identifies the important confusions, uncertainties or contradictions that surround the topic. In addition, the student brings to light misconceptions or confusions that are commonly overlooked.

Level 3:
The student, with no important errors, identifies a significant confusion, uncertainty or contradiction that surrounds the topic. The student forms an accurate assessment of these problems.

Level 2:
The student identifies confusions, uncertainties or contradictions that are associated with the topic, but the problems identified might include some but not all the most critical issues.

Level 1:
The student fails to accurately identify any confusions, uncertainties or contradictions that are associated with the topic.

c. Was the resolution to the confusion/contradiction logical and plausible about:

- o the concept (definitive investigation)
- o the past event (historical investigation)
- o the hypothetical event (projective investigation)

Level 4:
The student provides a logical and well-developed resolution to the confusion or contradiction. Additionally, the resolution reflects creative thinking as well as thoughtful attention to the details of the problem.

Level 3:
The student presents a clear resolution to the problems associated with the concept. The resolution is a logical and plausible outcome of the investigation.

Level 2:
The student develops and presents a resolution to a confusion/contradiction associated with the topic (definitive investigation) OR the past event (historical investigation) OR the future event (projective investigation). The resolution is satisfactory but the resolution lacks thorough treatment and accuracy in the logic in that resolution in some particulars do not seem entirely plausible.

Level 1:
The student presents an unsubstantiated and implausible resolution to the confusion/contradiction.

Generalized Rubrics for Systems Analysis Tasks

a. Did the student accurately and clearly identify the boundaries of the system?

Level 4:

The student provides evidence of a clear understanding of the system boundaries. The student's description of the boundary adds a new or deeper understanding of the operation of the system. In addition, the student fully describes the boundaries of other systems that share the system boundary.

Level 3:

The student, with no major errors, correctly describes the system boundaries. The student describes the boundaries in terms that provide a clear sense of the operation of the system.

Level 2:

The student draws boundaries of the system that exclude some significant part of the system, or that include aspects that are not part of the system.

Level 1:

The student makes many errors in describing the system boundary. The boundaries identified by the student exclude most important aspects of the system or confuse physical boundaries with system boundaries.

b. Did the student accurately and completely identify and articulate how the component parts interact?

Level 4:

The student accurately identifies how the key components of the system interact. Additionally, student's description provides insight into either the interaction of the components or the components themselves.

Level 3:

The student accurately identifies the key component parts of the system and the manner in which they interact.

Level 2:

The student accurately identifies how many of the key components of the system interact but leaves out some important components.

Level 1:

The student incorrectly describes how the component parts of the system interact and/or incorrectly identifies component parts.

c. Did the student accurately and completely describe how the system can fail?

Level 4:
The student describes the areas most likely to be the source of system failures. The student identifies potential failures that might commonly be overlooked. In addition, the student provides good suggestions for altering the system or its components in order to preclude some system failures.

Level 3:
The student describes the process by which a component failure could result in system failure. The student identifies the weakest and most vulnerable aspects of the system.

Level 2:
The student identifies most areas or parts of the system that are most vulnerable to catastrophic failures, but omits some important aspects. The student presents a not entirely plausible scenario of how such failures could occur.

Level 1:
The student fails to recognize possible causes of system failure, or addresses only the consequences and not the likely causes of system failure.

d. Did the student accurately describe how the system interfaces with the world outside it across the system boundaries?

Level 4:
The student describes with accuracy and thoroughness how the system communicates with the world outside it. In addition, the student provides some new insight about the system's interaction with other systems.

Level 3:
The student accurately describes the most important channels of communication and how other systems interact with the system at the system boundaries.

Level 2:
The student identifies the commonly used channels of communication, with an important omission, or the student does not correctly describe all important interactions between the system and its bordering systems.

Level 1:
The student cannot identify all the primary means of communication. The student does not understand how the system interacts with or is affected by other systems.

Generalized Rubrics for Problem Solving Tasks

a. Were the constraints or obstacles to the goal identified by the student accurate and comprehensive?

Level 4:
The student accurately identifies relevant obstacles or constraints to the goal and provides a thorough description. In addition, the student addresses obstacles or constraints that are not immediately apparent within the problem situation.

Level 3:
The student accurately identifies the most important obstacles or constraints to the achievement of a goal. The student describes the obstacle or constraint in detail.

Level 2:
The student identifies some constraints that are accurate but some constraints that are not accurate.

Level 1:
The student omits the most significant constraints or obstacles to the goal.

b. Were the alternative ways of overcoming the constraints or obstacles identified by the student viable and important to the situation?

Level 4:
The student identifies creative but plausible solutions to the problem under consideration. The solutions address the central difficulties posed by the constraint or obstacle.

Level 3:
The student proposes alternative solutions that appear plausible and that address the most important aspects of the problem.

Level 2:
The student presents alternative proposals for dealing with the obstacle or constraint, but the proposals do not all address the important difficulties.

Level 1:
None of the student's proposed solutions to the difficulty appear likely to succeed. They solutions fail to address a critical part of the problem.

c. Did the student adequately try out a selected alternative before trying another?

Level 4:
The student engages in an effective, valid and exhaustive trial of the selected alternative. Trial of the solution goes beyond that required to solve the problem and shows a commitment to in depth understanding of the problem.

Level 3:
The student puts the selected alternative to a trial adequate to determine its utility.

Level 2:
The student tries out the alternative, but the test of the solution is incomplete and omits or ignores important elements.

Level 1:
The student does not satisfactorily test the selected solution before discarding it.

d. If other alternatives were tried, how well did the student articulate and support the reasoning behind the order of the selection and the extent to which each alternative overcame the obstacles or constraints?

Level 4:
The student provides a clear, comprehensive summary of the reasoning that led to the selection of secondary solutions. The description includes a review of the decisions that produced the order of selection and how each attempted alternative fared as a solution.

Level 3:
The student describes the process that led to the ordering of secondary solutions. The description offers a clear defensible rationale for the ordering of the alternatives and the final selection.

Level 2:
The student describes the process that led to the ordering of secondary solutions. The description does not provide a clear rationale for the ordering of the alternatives, or the student does not address all the alternatives that were tried.

Level 1:
The student describes an illogical method for determining the relative value of the alternatives. The student does not present a reasonable review of the strengths and weaknesses of the alternatives solutions that were tried and abandoned.

Generalized Rubrics for Experimental Inquiry Tasks

a. Did the student accurately explain the phenomenon using appropriate and accepted facts, concepts and principles?

Level 4:
The student provides an accurate explanation of the phenomenon. The concepts and principles used for the explanation are appropriate to the phenomenon and accurately applied. The student's response reflects thorough and careful research or understanding.

Level 3:
The student provides an accurate explanation of the phenomenon. The concepts and principles used for the explanation are appropriate to the phenomenon and accurately applied with no significant errors.

Level 2:
The student explains the phenomenon but misapplies some concepts or principles, or omits some facts, concepts or principles that are important for understanding the phenomenon.

Level 1:
The student leaves out important facts, concepts or principles in explaining the phenomenon, or does not use appropriate facts, concepts or principles to explain the phenomenon.

b. To what extent did the prediction made by the student logically follow from the student's explanation?

Level 4:
The student makes a verifiable prediction that reflects creativity or insight into the character of the phenomenon. The prediction is entirely appropriate to the principles employed to explain the phenomenon.

Level 3:
The student makes a prediction that follows from the principles or concepts used to explain the phenomenon. The student's prediction can be verified.

Level 2:
The student makes a prediction that reflects a misunderstanding of some aspects of the concepts or principles used to explain the phenomenon, or makes a prediction that presents difficulties for verification.

Level 1:
The student makes a prediction that cannot be verified.

c. To what extent did the experiment truly test the prediction?

Level 4:

The experiment is a complete and valid test of the prediction and addresses all important questions raised by the prediction. In addition, the experiment is well designed to provide complete and accurate data and provides a model of the experimental design.

Level 3:

The experiment is a fair test of the prediction and addresses the most important questions raised by the prediction. The experiment provides accurate data for evaluation.

Level 2:

The experiment addresses some important aspects of the prediction, but omits others. The design of the experiment produces some errors in data collection or interpretation.

Level 1:

The experiment does not test the central question in the prediction. The experimental design is seriously flawed and collection of accurate data is unlikely.

d. To what extent did the explanation of the outcome of the experiment adequately relate to the student's initial explanation?

Level 4:

The student provides a complete and accurate explanation of the outcome of the activity or experiment and does so in terms of the relevant facts, concepts or principles. In addition, the student provides insights into the nature of the phenomenon studied, or the facts, concepts and principles used to explain it.

Level 3:

The student provides a complete explanation of the outcome of the activity or experiment with no important errors. The student presents the explanation in terms of the relevant facts, concepts and principles.

Level 2:

The student provides a general explanation of the outcome of the activity or experiment but omits one or two important aspects or the student may not relate the outcome very well to the concepts or principles that were employed to generate the prediction.

Level 1:

The student provides an inaccurate, highly flawed explanation of how the outcome relates to the original explanation.

Generalized Rubrics for Invention Tasks

a. To what extent would the invention proposed by the student improve upon the identified situation or meet the need that was identified?

Level 4:
The proposed invention provides a unique solution to the situation. The proposed invention reflects a high level of creativity.

Level 3:
The stated purpose provides a good answer to the identified situation or need.

Level 2:
The proposed invention will not provide a complete remedy for the situation.

Level 1:
The proposed invention has a little or no relation to the unmet need or situation described.

b. How rigorous and important were the identified standards or criteria the final invention should meet?

Level 4:
The student sets out rigorous criteria well suited to the purpose of the invention. The student identifies only the highest achievable standards of quality as the acceptable outcome of his product.

Level 3:
The student establishes an appropriate set of criteria for the invention.

Level 2:
The student identifies criteria for the invention that may not be completely appropriate to the product or the student sets standards for completion that do not ensure a worthwhile or completed product.

Level 1:
The student establishes criteria that fail to address the most important purposes for which the invention will be made. The student describes standards that are set so low that little quality can be expected.

c. How detailed and important were the revisions the student made on his initial model or draft?

Level 4:
The student reviews the draft or model at a considerable level of detail. The revisions or improvements clearly bring the product closer to fulfilling the purpose for which the it is designed. The student's attention to the details of the draft or model makes a high quality product likely.

Level 3:
The student revises the draft or model in such a way that the purpose of the product is served.

Level 2:
The student revises the draft or model but attempts to address only the most obvious difficulties.

Level 1:
The student makes few, if any attempts at correction and appears satisfied with the initial draft or model, although obvious difficulties still remain to be addressed.

d. To what extent did the final product meet the standards and criteria that had been identified?

Level 4:
The student develops a final product that meets the criteria established at a demanding level of quality. The product fulfills the purpose for which it was designed. In addition, the product reflects creativity and establishes a model for creative work of high quality.

Level 3:
The student continues the revision process until the product meets all standards and all criteria are satisfied. The product successfully serves the purpose for which it was designed.

Level 2:
The student revises the product until it meets minimum standards.

Level 1:
The student ends the process before the product has met minimum standards. The student's product does not meet many important criteria and fails in its purpose.

Generalized Rubrics for Collaborative Work

a. **Did the student work toward the achievement of the group goal?**

Level 4:
Commits to the achievement of the group goal and elicits commitment form others throughout the process; contributes significantly to the development of group goals or mission and to the identification of roles, strategies, and plans for those goals; works hard, often exceeding expectations and role responsibilities; regularly assesses progress toward goal achievement; leads in celebrating successes, overcoming setbacks, and learning from both.

Level 3:
Commits to goal achievement throughout the process; helps to define group goals or mission; completes assigned tasks and fulfills responsibilities given; makes suggestions throughout process for goal achievement; celebrates successes and helps to overcome setbacks.

Level 2:
Makes equivocal commitment to group goal, or abandons it when faced with difficulty; leaves some tasks unfinished and/or does not fully perform assigned role; rarely offers suggestions; does not celebrate success or work to overcome setbacks.

Level 1:
Makes no commitment to group goal; characteristically leaves tasks unfinished and does not execute the responsibilities of assigned role; does not offer suggestions, nor consider successes or setbacks.

b. **Did the student demonstrate effective interpersonal communication skills?**

Level 4:
Participates in group interactions without prompting and encourages others to participate; expresses ideas clearly and uses language that is precise and accurate; checks to insure that others have understood; solicits ideas from others and probes for clarity and elaboration; remains sensitive to own and others non-verbal cues and checks for accurate interpretations; expresses emotions in ways that encourage dialogue.

Level 3:
Participates in group interactions without prompting; expresses ideas clearly; listens to ideas of others; remains aware of own and others non-verbal cues; expresses emotions appropriately.

Level 2:
Requires occasional prompting from others to interact; expresses ideas that lack clarity or have not been thought through; not completely aware of own and others non-verbal cues; expresses emotions in ways that can interfere with effective communication.

Level 1:
Interacts with others only after prompting; presents ideas prior to giving them adequate reflection; unaware of the non-verbal cues of self and others; expresses emotion in ways that are disruptive.

c. **Did the student contribute to group maintenance?**

Level 4:
Contributes to an atmosphere where individual differences – knowledge, experiences, abilities, opinions, styles, ethnicity and cultural backgrounds – are considered a group strength; demonstrates respect for and an interest in individual group members; regularly seeks feedback from group members and offers feedback constructively; leads members to assess group functioning; offers insightful evaluations; contributes useful suggestions for maintaining and/or improving; guides group toward consensus, making sure all members have input; supports group actions.

Level 3:
Demonstrates respect for individual differences in knowledge, abilities, opinions, styles, ethnicity, and cultural backgrounds; responds positively to feedback from group members; participates in evaluation of group functioning and suggests ways to improves; contributes to group coming to consensus; supports group actions.

Level 2:
Accepts individual differences in knowledge, abilities, opinions, styles, ethnicity, and cultural backgrounds; responds to feedback from group members; accepts group consensus; does not work against group actions.

Level 1:
Demonstrates difficulty in accepting individual differences in knowledge, abilities, opinions, styles, ethnicity, and cultural backgrounds; ignores feedback from group members; attempts to undermine group effort.

d. **Did the student self-assess and monitor own behavior?**

Level 4:
Carefully assesses personal strengths and assumes responsibilities accordingly; knows when to provide leadership and when to set up opportunities for others to lead; knows when to speak and when to listen.

Level 3:
Assumes responsibilities consistent with personal strengths; expresses enthusiasm but does not dominate; tries to strike a balance between speaking and listening.

Level 2:
Takes on roles that do not always accord with personal strengths; tends to monopolize group discussion or sometimes refrains from speaking when feedback is appropriate.

Level 1:
Mistakes personal strengths and attempts to take on unsuitable roles; dominates discussion or does not respond to requests for feedback.

Generalized Rubrics for Effective Communication

a. Did the student communicate with diverse audiences?

Level 4:
Demonstrates the ability to communicate effectively with different audiences through a variety of strategies affecting the tone, style and message; employs communication techniques with perception and creativity; carefully studies the needs, knowledge, and interests of the audience.

Level 3:
Demonstrates the ability to adjust tone, style and message to communicate with different audiences; demonstrates an understanding of the needs, knowledge and interests of the audience.

Level 2:
Demonstrates some ability to adjust for audience, but has a limited command of strategies for varying tone, style and message for different audiences; work demonstrates some misconceptions about the characteristics of a given audience.

Level 1:
Demonstrates limited ability to adjust for the audience, and may not understand or use strategies for varying tone, style and message; demonstrates ignorance of towards the concerns or perspective of the audience.

b. Did the student communicate to serve a purpose?

Level 4:
Demonstrates skillful use of a variety of communication strategies to inform, entertain or persuade; work reflects creativity or originality; clearly and effectively communicates a thematic idea, feeling and/or belief.

Level 3:
Demonstrates an ability to communicate for a particular purpose, such as to inform, entertain, persuade in the communication of a thematic idea, a feeling or belief.

Level 2:
Communicates with limited effectiveness for a given purpose; produces some confusion or uncertainty in communication of an idea, feeling or belief.

Level 1:
Demonstrates difficulty communicating for a purpose; produces messages that do not convey an idea, feeling or beliefs.

c. **Did the student communicate effectively through a given medium?**

Level 4:
Demonstrates proficiency in a particular communication mode, such as speaking, writing and audio-visual media, and demonstrates creative and thoughtful approaches in its use; excels in work in a given presentation format, such as the debate, panel discussion, the essay and videotaped documentary.

Level 3:
Demonstrates competency in the use of a particular communication mode, such as speaking, writing and audio-visual media; demonstrates the ability to communicate using a given presentation formats, such as the debate, panel discussion, the essay and videotaped documentary.

Level 2:
Shows limited competency in a particular medium of communication; ability to communicate effectively is limited in the presentation format attempted.

Level 1:
Does not demonstrate the ability to use the communication mode effectively; lacks competence in the format of the presentation.

d. **Did the student communicate through a quality product?**

Level 4:
Demonstrates an ability to communicate through a product of high quality by the review, selection and consistent application of appropriate and demanding criteria for essential aspects of the communication: purpose, audience and media.

Level 3:
Demonstrates an ability to communicate through products by the review, selection and application of appropriate criteria for essential aspects of the communication: purpose, audience and media.

Level 2:
Demonstrates some ability in the review, selection and application of criteria for communication, but does not give consistently adequate and careful attention to the process.

Level 1:
Fails to review, select or apply criteria in the development a communication product.

Generalized Rubrics for Information Gathering

a. Did the student recognize where and how the project would benefit from additional information?

Level 4:
Performs a detailed and careful assessment of information needs before beginning the project; anticipates statements and conclusions that will require additional information; determines what information should be sought to provide new directions or insight.

Level 3:
Assesses the project to identify areas that require information for clarification or support; seeks information to confirm or verify statements or conclusions.

Level 2:
Seeks information on an as needed basis; does not preview project for information needs; does not consistently seek out information to support statements or conclusions.

Level 1:
Does not recognize where a project requires or would be helped with additional information; does not seek information to support statements or conclusions.

b. Did the student search for and acquire information?

Level 4:
Demonstrates an extensive knowledge of basic information sources; commands a wide range of skills in using tools to retrieve information; demonstrates creativity and resourcefulness in the collection of data and the creation of original data.

Level 3:
Demonstrates a knowledge of basic information resources and services, such as libraries, computer databases and encyclopedias; demonstrates skills in using tools to retrieve information, such as bibliographies, indexes and computer searching techniques; demonstrates an ability to acquire information independently through observation skills and techniques such as the interview and survey.

Level 2:
Demonstrates some basic knowledge of information resources but does not identify all likely sources; has limited skills in using tools to retrieve information; requires close guidance in the collection of data through personal observation.

Level 1:
Demonstrates little familiarity with resources; demonstrates only rudimentary skills in the use of some tools; can provide little or no dependable data through personal observation.

c. **Did the student assess the value of information?**

Level 4:
Accurately determines the relevance and value of all information gathered for the task; with careful analysis determines the credibility and accuracy of the information and the authority of the source.

Level 3:
Determines the relevance of information for the project; determines the credibility of information by evaluating its credibility, accuracy and the authority of the source.

Level 2:
Applies some information that is not directly relevant to the task; accepts information that closer scrutiny shows is not entirely credible or accurate.

Level 1:
Usually accepts information at face value; does not examine information closely for accuracy or credibility.

d. **Did the student interpret and synthesize information?**

Level 4:
Exhausts data for factual information, and for supplementary information such as that conveyed by context and connotation; distinguishes data from the inferences of others and provides well reasoned inferences from data; synthesizes data from disparate sources to provide new insight into the task at hand.

Level 3:
Accurately reads and interprets data for information; makes reasoned inferences from data; synthesizes information from sources to provide support for the task.

Level 2:
Cannot consistently interpret data for information; sometimes fails to make reasoned inferences; uses information without prior synthesis or integration.

Level 1:
Does not interpret information in a way that contributes to the task; fails to integrate information.

Generalized Rubrics for Self-regulation

a. Did the student seek different perspectives and consider choices before acting?

Level 4:
Recognizes when consideration of options would be beneficial; remains flexible and explores possibilities before proceeding; seeks out opinions and advice from reliable sources; considers all options and suggestions completely and carefully before acting.

Level 3:
Identifies situations that could benefit from options; remains open to alternative approaches before proceeding; considers the opinions and advice of others, but acts only after careful consideration.

Level 2:
Sometimes fails to recognize the value of considering options; occasionally resists considering alternative views; overvalues or undervalues the opinions and advice of others; sometimes acts without careful thought.

Level 1:
Fails to recognize the advantage of different perspectives or to consider options; remains inflexible; adopts or ignores advice from others without consideration.

b. Did the student push the limits of his/her abilities and persevere when faced with difficult situations?

Level 4:
Seeks challenges as a means of learning and to increase competence; strives to exceed expectations; overcomes problems and adversity with a positive, but realistic perspective.

Level 3:
Accepts or creates challenges for oneself that push the limits of one's ability; meets challenging expectations; perseveres through difficulties; maintains a positive outlook.

Level 2:
Accepts challenges that do not create a real test of abilities or are not demanding; does not consistently persevere to master problems or difficulties; occasionally takes on a negative or defeatist perspective

Level 1:
Avoids challenges that test the limits of abilities; quick to drop a task in the face of difficulties; takes on a defeatist or apathetic view of difficulties.

c. Did the student establish clear goals and manage progress towards achieving them?

Level 4:
Carefully considers priorities and sets goals accordingly; generates plans for goal achievement that reflect insight into personal strengths and weaknesses; regularly evaluates behavior and continually works to improve on original plan; after achieving or changing goal, reflects on process and critically analyzes what worked and what did not in order to improve future performance.

Level 3:
Sets clear personal goals, generates a plan for goal achievement; evaluates progress and makes modifications when necessary; after achieving or changing goal, reflects on effectiveness of plan.

Level 2:
Sets personal goals that lack complete clarity; does not complete a plan for goal achievement; does not consistently or reliably evaluate progress or make adjustments for improvement; often fails to consider performance after the achievement or change of goals.

Level 1:
Rarely sets personal goals; fails to make a workable plan for the accomplishment of a goal; does not evaluate progress or make adjustments towards the goal; does not reflect on work towards a goal.

d. Did the student generate and pursue personal standards of performance?

Level 4:
Generates clear personal standards of performance by thoughtful consideration of both accepted and established criteria and personal priorities and goals; monitors progress toward standards by eliciting feedback, applying criteria, and generating plans for improving.

Level 3:
Generates personal standards of performance that incorporate established criteria and personal priorities and goals; monitors progress toward standards by applying criteria and identifying areas for improvement.

Level 2:
Recognizes and applies personal standards of performance, but has difficulty generating them or reviewing standards for consistency with accepted criteria or personal priorities and goals; inconsistently monitors progress towards goals, and makes sporadic efforts for improvement.

Level 1:
Cannot generate personal standards of performance; infrequently applies standards of performance or considers established criteria; makes little or no effort to monitor the quality of personal efforts.

APPENDIX F

SECURED TASKS

ELEMENTARY LEVEL

COMPARISON

(Students work independently for a 45 minute period of time. They can use their textbooks and their notes. At the end of the time period they present their conclusions on a chart.)

You have been studying two types of literature - the fable and the tall tale. Show how these types of literature are alike in two ways and how they are different in two ways.

CLASSIFICATION

(Students work independently for a 45 minute time period at the end of which they present their conclusions on a chart.)

We have been learning about different animals in the zoo: the lion, the ostrich, the python, the orangutan, the elephant, the zebra, the owl, the puma, the buffalo, and the alligator. Organize these animals into at least three groups and explain why you grouped them the way you did.

STRUCTURAL ANALYSIS

(Students are shown a five minute videotape describing the workings of an ant colony. The are also given a written script of the content of the videotape. At the end of a 45 minute period of time, they present their conclusions in written form.)

In the videotape you learned about ant colonies. What was the most important piece of information they were trying to present in the videotape? How did you know it was the most important.

SUPPORTED INDUCTION

(Students are read information about a fictitious city in the United States that is not in their state. They are also provided with pictures representing the information that is read to them. They are then given 30 minutes to draw their conclusions which are presented in written form with accompanying pictures.)

You have just heard information about a make believe city in the United States. Based on the information you have heard, what can you conclude about the people in this city and they way that they live? Explain how you came to each of your conclusions.

SUPPORTED DEDUCTION

(Students work independently for a 35 minute period of time, at the end of which they turn in their conclusions on an audiotape. They may use their books and their notes.)

Pretend that you are asked to read a story and are told that it is a fable. Before you begin to read it, what could you conclude must be in the story? Explain why you know these things must be in the story and give an example of each thing you identify.

ERROR ANALYSIS

(Students work independently for a 25-minute period, at the end of which time they present their reasoning on an audiotape.)

Gabrielle enters 1,585 x 2.7 into her calculator. The display reads 42790.5. Is this answer reasonable? Explain.

CONSTRUCTING SUPPORT

(Students work independently for a 40 minute time period, at the end of which they present their argument on an audiotape. They may use their textbooks and their notes.)

What do you think about using animal fur for coats? Construct an argument for or against their use.

EXTENDING

(Students are read the story *Jack and the Beanstalk*. They then work independently for 20 minutes at the end of which they record their answers on audiotape.)

Can you think of something that is not another story, that is very much like *Jack and the Beanstalk*. It might be something that happened to you or something you heard about. When you have selected something that is like *Jack and the Beanstalk* explain what it is and how it is alike. Remember, you can't use another story.

DECISION MAKING

(Students are provided with information about various types of bicycles. Working independently they use this information to make a selection as to the type of bicycle they would like to buy. They report their decision in written or outline form.)

Which bike would be best for you? Make sure you clearly explain why the one you have selected is the best.

INVESTIGATION

Investigation (Definitive)

(Students are provided with a worksheet with sets of turnaround facts i.e, 4 + 2 = 6; 2 + 4 = 6; sums to 8. They work independently with counters modeling the turnaround facts. At the end of a 15-minute time period, students explain their description of turnaround facts on audiotape.)

We have been learning addition facts with sums to 8. The facts on this worksheet are special. They are called turnaround facts. Model the facts with your counters. Explain why you think they are called turnaround facts. What do you notice about the addends? What do you notice about the sums?

Investigation (Historical)

(Students work independently for two hours. They can use reference books about the environment and their textbooks. At the end of the time period, students present their conclusions as a written report.)

The plastic rings that hold six-packs of soft drinks are a danger to the fish in the ocean. Some environmentalists claim that people that litter are responsible for killing a large portion of sealife in our waters. Explain how these six-pack holders have been a threat to fish.

Investigation (Projective)

(Students may use any notes or their social studies book over a one-hour time period. At the end of the time period, the students present their ideas in an oral report.)

When the Otis Steam Elevator Company installed the first passenger elevator in a shop in New York City in 1857, it made a major impact on businesses and construction. Pretend that the elevator was never invented. Describe what the world would look like. How would this change your everyday life? What kinds of things would you no longer be able to do?

SYSTEMS ANALYSIS

(Students are provided with a worksheet with several function machines using the operations of addition and subtraction. They work independently for a 45-minute period. At the end of the time period, they present their findings orally.)

This is a function machine. It is used to add numbers. It can also be used to subtract numbers. Look at the worksheet. How does the machine work? What are the parts and how do they go together? What happens when one part changes?

PROBLEM SOLVING

(Students work independently for a 45-minute period. They can use their textbooks and books about the environment. At the end of the time period they present their ideas in a chart.)

There are some hunter-gatherer tribes still living in remote regions of the tropics. Pretend you are one of those hunter-gatherers. However, you have broken your leg and cannot move very quickly. Desribe what you would do to still be able to hunt and gather. What would be your limitations in hunting and gathering?

EXPERIMENTAL INQUIRY

(Students work independently for a 25-minute period and present their results in a chart along with a written explanation.)

How many times do you need to roll a 6-sided number cube in order to roll all six numbers? Describe what you observed when you first started to roll the dice, what you predicted and what you concluded.

INVENTION

Students work independently for a three class period, and have access to graph paper, rulers, and their textbooks. They present their scale drawings along with an audiotape explanation.)

Using a scale drawing, design a state-of-the art entertainment center to be used to house all of the latest electronic equipment. Be sure that the dimensions of the audio and video equipment is fairly standard.

SECURED TASKS

MIDDLE SCHOOL AND JUNIOR HIGH LEVELS

COMPARISON

(Over a one and one-half hour period, students work individually using their notes and textbooks. At the end of that time period, they submit an informal outline.)

Slavery or bondage has been a way of life in many societies throughout history. Write an essay comparing a week in the life of a Roman slave and a week in the life of a slave in the American South prior to the Civil War. Make sure that the things on which you compare the two, illustrate important characteristics of the societies in Rome and in the South.

CLASSIFICATION

(Over a two hour period of time, students work independently to produce a chart depicting their classification system. Teachers accompany students to the site. Students are then given an additional hour in the classroom to redraw and polish the chart. Books and notes may be used.)

In a moment you will be taken to a small area of ground (urban or prairie). Develop a classification system for the items you find there. Present your system in a chart and be prepared to explain why you used the categories you did.

STRUCTURAL ANALYSIS

(Students work independently over a period of two hours. They are provided with the story of Daedalus and Icarus which they have previously been exposed to. They are also given a reproduction of the painting "The Fall of Icarus." During the two hours, they may use their notes. The final product is a written report.)

Read the story of Daedalus and Icarus from Greek mythology and then examine the painting "The Fall of Icarus" by Pieter Brueghel, Sr. Discuss the figures and objects in the painting and their relationship to the story. Describe how the main idea from the story is depicted in the painting.

SUPPORTED INDUCTION

(Students work independently over a two hour period of time. They are provided with a copy of a newspaper. At the end of the period they present their findings in essay form.)

As an archaeologist in the year 2491, you unearth a newspaper from the year 1992 buried in a plastic bag (non-biodegradable) in a landfill. This is the only information archaeologists have on this lost society. It is a momentous discovery and you have been chosen to write a description of the lost society. Using only the articles and advertisements in the paper, what inferences can you make about this society? Explain the conclusion you came to and the information you used to form your conclusions.

SUPPORTED DEDUCTION

(Students work independently over an hour period of time. They can use their notes and their textbooks. At the end of an hour, they present their answers in written form.)

You are walking through a museum of natural history and come across a type of animal you have never heard of before. The only information provided about this animal is that it is a type of mammal. What could you conclude must be true about the animal? Explain your reasoning.

ERROR ANALYSIS

(Students work independently using textbooks, notes, etc. At the end of that period they make an oral presentation to the rater and respond to questions.)

In the Medieval times, women were convicted of witchcraft if they survived a variety of "tests" such as the dunking pool. Similarly, criminals were found innocent or guilty by their reactions to treatment such as placing their hands in boiling oil. Using these practices or some others of your own choosing, describe the specific errors in reasoning the people of these times used in judging people as witches.

CONSTRUCTING SUPPORT

(Over a two hour period, students work independently using textbooks and notes. Their arguments are presented in essay form.)

The Revolutionary war began as a result of differences between the Colonists, who were British citizens, and King George III of Britain. For years, the Colonists had protested Britain's policy of taxing the Colonies without giving them representation in Parliament. However, the British believed they had the right to tax the Colonies to help pay for the protection of the Colonies. For example, Britain spent a great deal of money on the French and the Indian war which was fought to make the

Colonies safe. In 1776, some of the Colonists decided to split with Britain and laid out their reasons for doing so in the Declaration of Independence. Many people had to take sides in this quarrel which split homes and families. Imagine that you are a colonist and have to make a choice and defend that choice to your family. Construct an argument as to why you wish to stay allied to Britain or cut the ties and become independent.

EXTENDING

(Students work independently over an hour's period of time. They can use their notes and textbooks. At the end of an hour, they present their conclusions in essay form.)

Ants live in social groups just like humans. Like humans, they have rules in their society. Describe some of the rules that govern ant societies. Then describe how the patterns you have identified in the insect kingdom are like the patterns that you see in human society.

DECISION MAKING

(Over a three hour period of time, students view a 15 minute video on the impeachment trial of Andrew Johnson, and are allowed to take notes. Then, using their notes and textbooks, the students prepare an oral presentation that is made at the end of the three hour time block.)

In the videotape, you saw that in 1886, Congress held an impeachment hearing for President Andrew Johnson, successor to Abraham Lincoln because Johnson dismissed a government officer. But, as the videotape showed, many members of Congress wanted to impeach Johnson because he went against their wishes about how to treat the South after the Civil War. You are Edmund G. Ross, a one-year Republican Senator from Kansas who has served in the Union Army, and you dislike Johnson. But, you have to weigh your feelings against what you believe is best for the country. You know that yours will be the vote that decides whether to impeach Johnson or not. List the arguments for both sides and consider the consequences of the action. Using only the information available to Edmund G. Ross, make a decision and explain why you voted the way you did.

INVESTIGATION

Investigation (Definitive)

(Students are provided with a copy of the Second Amendment to the Constitution and are allowed to use textbooks and notes. They work independently for a two hour time period at the end of which they present their conclusions in written form.)

The Second Amendment to the Constitution talks about the right of the people to keep and bear arms. The phrase "right of the people to keep and bear arms" has led to a great deal of controversy and discussion. Explain what you think is the intent of this amendment. Back up your explanation with clear examples of how this amendment could be reworded to reflect your views and clear up the confusion?

Investigation (Historical)

(Students work independently for an hour and a half. They can use their notes, any previous research they may have done and their textbooks. At the end of the time period, students present their conclusions as an oral report.)

The Anasazi lived in the Four Corners area of the United States 1,000 years ago. Then about 1300 AD, all signs of their civilization ceased. Some archaeologists say that they migrated out of the area because of drought or famine. Others say they integrated with other tribes who settled in the area and left their cliff dwellings for a different lifestyle. Describe your explanation for why the Anasazi disappeared and show how it is different from and why it is better than other explanations.

Investigation (Projective)

(Students may use any notes, previous research they may have done, and their textbooks over a one-hour period of time. At the end of the time period, the students present their conclusions in essay form.)

Pretend that there are no fossil fuels available for human use due to some catastrophic event. Other fuels and potential energy sources are available such as wood, water, sunlight, etc. Describe what your life is now like. For instance, you might describe such things as the contents of your trash, your food (how it is produced, distributed, packaged, etc.), what your school is like, how it is powered and heated and how you get there. For each important aspect of your life you describe, clearly show how it relates to the lack of fossil fuels.

SYSTEMS ANALYSIS

(Over a two hour time period, students use their textbooks, notes and the results of previous research. At the end of the time period, students present a detailed chart with a written explanation.)

In a diagram, show the different items that are in the food chain for a mountain lion. Then describe the natural methods of change that are found within the system and how the lion adapts to change. Also describe what would happen if a part of the system was removed or interfered with because of drought or pollution.

PROBLEM SOLVING

(Students work independently or in pairs over a two hour period of time. They are provided with a detailed topographical map on which to trace their route. At the end of the time period, student's present their route traced on the map accompanied by explanations in written form.)

The year is 1850. You are the wagon master of a wagon train of pioneer families on its way from Ohio to California. Unfortunately, none of the wagons are able to go through water and your bridge and raft building capabilities on the trail are extremely limited. You may use bridges or ferries that actually existed in 1850. It is your job to find a new route for the wagon train which will eliminate taking the wagons through water. Your journey may take as long as you like but must take the seasons into consideration. Trace your route on a map.

EXPERIMENTAL INQUIRY

(Suggested time: 2 weeks. This task should be conducted in two stages. Stage 1. Students work individually for one hour to produce a written design for a study, including how they will collect and interpret data. The rater works with the student to examine and eliminate obvious flaws. The student is then given two weeks to collect data. Stage 2. The student interprets and presents the findings in a written and oral report to the rater and responds to questions about conclusions drawn.)

Example of a study
On your way to school in the morning, you notice that more male drivers seem to be running red lights than female drivers. Assume that this is true and describe some possible explanation for this behavior? Next, make a prediction based on your explanation and design a study that will test your explanation. Carry out your study and discuss the results in relationship to your original explanation.

INVENTION

(Over a two hour period of time, students are shown a videotape and asked to invent a process more efficient than the one shown in the tape. Students work independently and have access to notes, drawing tools, textbooks and previous research.)

In the video you watched an Eskimo catch fish using primitive tools. Using modern tools, invent a more efficient way of catching fish in the same river.

SECURED TASKS

HIGH SCHOOL LEVEL

COMPARISON

(Students work individually and are given one hour to finish the task. They may use their notes and their textbooks. Their responses are reported in essay form).

How do diamond and zirconium compare in terms of their scarcity? What would happen in the marketplace if either should become scarce? For the two characteristics identified above describe how diamond and zirconium are similar and different.

CLASSIFICATION

(Students work independently and are given two hours to complete the task. While working on the task they are provided with the necessary documents and information to construct their answers. At the end of the two hours students present their answers orally to a panel of teachers).

There are many different regions within our state (neighborhoods, mountains, counties, cities, etc.) The various types of regions can be organized into categories by considering how people use the environment. For example, people can use the environment for dwellings, recreation or for natural resources. That is, three categories of regions based on their use are: 1) those used for dwellings, 2) those used for recreation and 3) those used for natural resources. In our state examples of each of these categories of use exist. Provide at least three examples within our state for each of the three categories of how regions can be used. Make sure you describe the defining characteristics of each category (e.g., what are the characteristics of regions used for dwellings, etc.)

STRUCTURAL ANALYSIS

(Working independently, students are provided with a newspaper editorial. The students must complete the task in an hour and submit their responses in outline form).

The main idea of this newspaper editorial is that the city's plan for a new baseball stadium is not sound. Two reasons the author gave is that the site has inadequate parking and is too far from the city's population base. Describe in outline form the support provided for these reasons along with the other reasons listed and their support. Make sure you identify any subthemes along with the support for those themes.

SUPPORTED INDUCTION

(Students work independently for a 1 1/2 hour period of time. They are allowed to use their notes and their textbooks. At the end of the time period they present their answers in essay form).

Green plants produce their own food by taking energy from the sun and using air, water and minerals from their environment. Animals eat plants and other animals. When animals die they decompose and form part of the organic nutrients in the soil. What generalizations can you make about how energy flows through an ecosystem? Describe the specific points you used in drawing your conclusion and the reasoning behind it.

SUPPORTED DEDUCTION

(Students work independently over a three hour period of time. They are provided with a videotape illustrating a New England town meeting and a Senate debate. At the end of the period they present their answers orally to a panel of judges).

The complexity and number of layers within a political system determines the degree of access individuals have to the decision-making process. Based on this generalization, what conclusions could you draw about the differences in decisions that are made in a New England town meeting versus a senate debate? Also, what conclusions can you draw about the differences between a participatory and a representative democracy? Illustrate your conclusion with specific examples.

ERROR ANALYSIS

(While working independently over a 1 1/2 hour period of time students are presented with an advertisement. They may also use their notes regarding common types of fallacies found in advertising. At the end of the time period students present their answers in written form).

This recent advertisement suggests that 'one million people can't be wrong' for having selected the product advertised. But certainly one million persons can each buy a product once and decide that they don't like it. It's an error then, to assume that based on the fact that one million people bought the product, you should buy the product. Describe what effect this claim has on (or is intended to have on) the viewer. Additionally, describe how the advertiser could present this information in a manner that is not misleading.

CONSTRUCTING SUPPORT

(While working independently during a 1 1/2 hour time period, students are allowed to use their textbooks and their notes. At the end of the period they present their answers in written form).

Some physicians assert that at the first sign of physical pain, a person should seek to lessen the intensity of sound causing the pain. They argue that pain is a sign of injury to the body, thus hearing loss occurs at the first sign of pain. Either provide more evidence to support this claim or provide evidence to counteract. Be sure to qualify your conclusions.

EXTENDING

(While working independently for a 3 hour block of time students are presented with a videotape containing clips from TV dramas and situation comedies. At the end of the time period they present their conclusions orally to an expert rater).

Dramatic series on television have a structure different from comedies. For example, we don't have the term 'situation drama', because dramas are usually concerned with the development of a story line over several episodes. Like situation comedy, TV drama series rarely depict a character developing or changing over time, although characters may be drawn in greater depth. In what other abstract ways are the two genres similar and different? For example, how might they differ in their use of a character flaw to provide motivation? How would either genre use the unexpected or improbable event as a means of altering the plot direction?

DECISION MAKING

(Students work independently for a period of 2 hours. During that time they may use their notes. They are also provided with two articles describing the background to Queen Isabella's decision. At the end of the period they present their answers in written form).

You are Queen Isabella and must decide whether Columbus should be funded. You should not use benefit of hindsight, but work only with what was available to Queen Isabella at the time. Your primary concern as Queen is to keep the public treasury sound and to work for the public good. However, you are also very interested in establishing new trade routes. You should consider the costs of an ocean venture both in monetary terms and possible loss of life. There are no guarantees of success. Make the choice and defend it.

INVESTIGATION

Investigation (Definitive) (Students work independently for a two hour period. They are provided with an article on the concept of a democracy. At the end of the two hours students present their findings orally).

Your task is to describe the critical attributes of a pure democracy. Specifically, determine and describe the essential characteristics of a democracy - those elements without which a political system is not a democracy. Additionally, identify elements that are commonly associated with a democracy but are not necessarily defining characteristics. Finally, describe one or more conflicting viewpoints about democracies and then state and defend your viewpoint on the issue.

Investigation (Historical) (Students work independently for a two hour period of time. They can use their notes and their textbooks. At the end of the period they present their findings in written form).

What happened to the Dinosaurs? There are competing theories as to how dinosaurs became extinct. All of the theories, though, agree that it had something to do with the environment. Some say that an ice age caused their demise, others, that a comet sent dust into the atmosphere and blocked off the sun's rays. How could either scenario explain the dinosaurs' extinction? What evidence could be brought to support or refute either theory? Can you suggest a way to resolve this puzzle?

Investigation (Projective) (While working independently over a 2 hour time period students are allowed to use their notes and their textbook. At the end of the period they make their presentations orally).

While England was the first country to begin industrializing in the late 19th century, a number of countries did not start until late in this century. As non-industrialized countries now begin to become industrialized, it's essential that we understand what kind of effect such industrialization might have on the country in question as well as the world community. Select one country in the early stages of industrialization and describe those changes that we can predict with certainty. Identify those areas that give rise to the greatest concerns about the wisdom of transforming that society to an industrial society. Describe a scenario that might provide the best of both worlds for the country -- the benefits of an industrial society without its hazards.

SYSTEMS ANALYSIS

(Students work independently for a three hour block of time. They are provided with a videotape of the last three board meetings. At the end of the time period they present their findings orally).

Analyze a typical meeting of our school board as a system for communicating information (video tapes of the last three sessions are available to you) Define the components of your system, and the boundaries -- those areas that describe the limits of the school board's authority or interest. Identify the type of errors that can creep into information as it is used within the system and how the system goes about correcting errors. Finally, describe the interface of the system to the world outside it, for example, describe the change in character of information when the system receives communication from other systems and communicates with other systems.

PROBLEM SOLVING

(Students work independently for a period of two hours. They are allowed to use their notes and their textbooks. At the end of the two hours students make their presentations in written form).

Using numbers in a home address makes it easy to find a house because the house numbers are always in ascending or descending order. Street numbers instead of street names are also easy to find. But each day we seem to find more numbers instead of names -- ID numbers, social security numbers, telephone numbers. Is there a way we can have the efficiency of numbers, but the use words and names in place of them? In our residential and business addressing scheme, for example? How would you design a grid system that wouldn't use numbers at all on streets or houses, but would still make it easy for someone to find an address? List at least two possible solutions to your problem. Select one alternative and describe how you determined it was the best solution. Finally, describe in detail one section of addresses and explain how it accomplishes the goal of making it easy to find an address without the use of numbers on streets or houses.

EXPERIMENTAL INQUIRY

(Students work in pairs for a 3 hour period of time. At the end of that time period they present their findings orally along with a demonstration of their experiment).

You've observed that when you are descending in an elevator, you feel heavier as the elevator comes to a stop. Have you gained weight suddenly, then lost it again? How can you explain this? Based on your understanding of the principles involved, make a prediction about the extent to which a given object will weigh differently and in a specific situation. Set up an experiment that will test your prediction and carry out the experiment and then describe whether your experiment proved or disproved your hypothesis, and the extent to which the principles you've described still hold true. You may use any of the equipment in the classroom to set up your experiment.

INVENTION

(Students work independently for a 1 1/2 hour block of time. At the end of that time period they present a sketch or a diagram and make an oral report.

Someday people will live on the Moon. The environment there is very harsh, though, and people will need a place to live that will support them. Invent something that will conserve water in some way. Explain what aspects of lunar environment you have taken into consideration when you created your invention (limited space, resources, etc.). Develop a diagram or sketch of the product.

REFERENCES

Amabile, T.M. (1983). *The social psychology of creativity*, New York: Springer-Verlag.

Anderson, J. (1983). *The architecture of cognition*. Cambridge, MA: Harvard University Press.

Anderson, J. (1990). *Cognitive psychology and its implications*. New York: W.H. Freeman and Company.

Anderson, J.R. (1990b). *The adaptive character of thought*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Applebee, A., Langer, J. & Mullis, I.V.A. (1986a) *The reading report card. Progress toward excellence in our schools. Trends in reading over four national assessments, 1971-1984*. Princeton, NJ: Educational Testing Service.

Applebee, A.N., Langer, J.A. & Mullis, I.V.A. (1986b), *The writing report card: Writing achievement in American schools*. Princeton, NJ: Educational Testing Service.

Atwell, N.C. (1987). *In the middle*. Portsmouth, NH: Heinemann

Baker, E.L., O'Neil, H.F. Jr. & Linn, R.L. (August, 1991). *Policy and validity prospects for performance-based assessment*. Paper presented at the annual meeting of the American Psychological Association, San Francisco.

Baron, J.B. (1991). The learner and assessment systems: Are they compatible? Paper presnted at the Wingspread Conference in Assessing Learning and Educational Achievement. Sponsored by the American Psychological Association and the Mid-continent Regional Educational Laboratory

Belanoff, P. & Dickson, M. (1991). Portfolios: Process and product. Portsmouth, NH: Boynton/Cook Publishers.

Berk, R.A. (Ed.) (1986). Performance assessment. Baltimore: Johns Hopkins University Press.

Beyer, B.K. (1988). Developing a thinking skills program. Boston, MA: Allyn & Bacon.

Block, J.H. (1985). Making school learning activities more playlike. In D.U. Levine (Ed.), Improving student achievement through mastery learning programs (pp. 69-90). San Francisco: Jossey-Bass.

Brown, A.L. (1978). Knowing, when, where and how to remember: A problem of metacognition. In R. Glaser (Ed.), Advances in instructional psychology. (Vol. 1, pp. 77-165). Hillsdale, NJ: Erlbaum.

Brown, A.L. (1980). Metacognitive development and reading. In R.J. Spiro, B.C. Bruce, & W.F. Brewer (Eds.), Theoretical issues in reading comprehension. Hillsdale, NJ: Erlbaum.

Bush, G. (April, 1991). America 2000: The president's education strategy: Fact sheet. Washington, D.C.: Office of the Press Secretary, The White House.

Calkins, L.M. (1986). The art of teaching writing. Portsmouth, NH: Heinemann.

Carey, N. & Shavelson, R. (1989). Outcomes, achievement, participation, and attitudes. In R.J. Shavelson, L.M. McDonnell, & J. Oakes (Eds.), Indicators for monitoring mathematics and science education. Santa Monica: The RAND Corporation.

Clark, M. (1989). Biological and health sciences: Report of the project 2061 phase I biological and health sciences panel. Washington, D.C.: American Association for the Advancement of Science Inc.

Costa, A. (1984). Mediating the metacognitive, Educational Leadership, 42, 57-62.

Cronbach, L.J. (1960). Essentials of psychological testing. (2nd edition). New York: Harper and Row.

Davey, B. & Rindon, D.A. (April, 1990). Anatomy of a performance task. Paper presented at the annual meeting of the American Educational Research Association, Boston.

Doyle, W. (1983). Academic work, Review of Educational Research, 53, 159-199.

Eisner, E.W. (1991). What really counts in schools. Educational Leadership. 48 (5), 10-17.

Ennis, R.H. (1985). Goals for a critical thinking curriculum. In A. Costa (Ed.), Developing minds: A resource book for teaching thinking (pp. 54-57). Alexandria, VA: Association for Supervision and Curriculum Development.

Ennis, R.H. (1987b). A taxonomy of critical thinking dispositions and abilities. In J. Baron & R. Sternberg (Eds.), Teaching thinking skills: Theory and practice. New York: Freeman.

Ennis, R.H. (1989). Critical thinking and subject specificity: Clarification and needed research. Educational Researcher, 18 (3), 4-10.

Fanning, J.M., (1992). Purposeful Inquiry: Making Curriculum Relevant. Unpublished manuscript, Mid-continent Regional Educational Laboratory, Aurora, CO.

Finch, F.L. (1991). Issues in educational performance evaluation. In F.L. Finch (Ed.) Educational performance assessment (pp. 1-18). Chicago: Riverside Publishing Company.

Finch, F.L. (1991). Educational performance assessment Chicago: Riverside Publishing Company.

Fiske, E.B. (1990). Smart schools, smart kids. New York: Simon and Schuster.

Fitzpatrick, R. & Morrison, E.J. (1991). Performance and product evaluation. In F.L. Finch (Ed.) Educational performance assessment (pp. 89-138). Chicago: Riverside Publishing Company.

Flavell, J.H. (1976). Metacognitive aspects of problem solving. In L.B. Resnick (Ed.), The nature of intelligence. Hillsdale, NJ: Erlbaum.

Flavell, J.H. (1977). Cognitive development. Englewood Cliffs, NJ: Prentice-Hall.

Frederiksen, J.R. & Collins, A. (1989). A systems approach to educational testing. Educational Researcher, 18 (9), 2-32.

Gagne, R.M. (1989). Studies of learing: 50 years of research. Tallahassee, FL: Learning Systems Institute, Florida State University.

Geographic Education National Implementation Project (1989). 7-12 Geography: Themes, key ideas and learning opportunities. Skokie, IL: Rand McNally, Educational Publishing Division.

Glaser, R. (1991). Intelligence as an expression of acquired knowledge. In H.A.H. Rowe (Ed.) Intelligence: Reconceptualizations and measurement (pp. 47-56). Hillsdale, N: Lawrence Erlbaum Associates.

Glasser, William, (1984). Control Theory: A New Explanation of How We Control Our Lives. New York: Harper & Row, Publishers.

Goodlad, J.I. (1984). A place called school. New York: McGraw-Hill.

Goodlad, John I., (1988). Coping with Curriculum. In P.W. Jackson (Ed.), Contributing to Educational Change: Perspectives on Research and Practice (pp. 179-190). Berkeley, CA: McCutchan Publishing Corporation.

Halpern, D.F. (1984). Thought and knowledge: An introduction to critical thinking. Hillsdale, NJ: Erlbaum.

Harter, S. (1982). A developmental perspective on some parameters of self-regulation in children. In P.Karoly & F.H. Kanfer (Eds.), Self-management and behavior change: From theory to practice (pp. 165-204). New York: Pergamon Press.

Hillocks, G. (1986). Research on written composition, Urbana, IL: ERIC Clearinghouse on Reading and Communication Skills and National Conference on Research in English.

Hirsch, E.D., Jr., (1987). Cultural literacy: What every American needs to know. Boston: Houghton Mifflin.

Hutchins, C.L. (1991). A+: Achieving excellence. Aurora, CO: Mid-continent Regional Educational Laboratory.

Huynh, H. (1985). Assessing mastery of basic skills through summative testing. In D.U. Levine (Ed.) Improving student achievement through mastery learning programs (pp. 185-202). San Francisco: Jossey-Bass.

Jaques, E. (1985). Development of intellectual capability. In F.R. Link (Ed.). Essays on the intellect. (pp. 107-142). Alexandria, VA. Association for Supervision and Curriculum Development.

Johnson, D.W. & Johnson, R.T. (1987). Learning together and alone. (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Johnson, D., Johnson, R.(1986). Ten inference types and a three-step teaching procedure for inferential comprehension. Journal of reading, 29, 622-625.

Johnson, D.W., Johnson, R.T., Roy, P. & Holubec, E.J. (1984). Circles of learning: Cooperation in the classroom. Alexandria, VA: Association for Supervision and Curriculum Development.

Jones, B.F. & Spady, W.G. (1985). Enhanced mastery learning and quality of instruction. In D.U. Levine (Ed.), Improving student achievement through mastery learning programs (pp. 11-44). San Francisco: Jossey-Bass.

Kulm, G. (1991). Assessing higher order mathematical thinking: What we need to know and be able to do. In G. Kulm (Ed.) Assessing higher order thinking in mathematics. Washington, D.C.: American Association for the Advancement of Science.

Langer, Ellen J., (1983). The Psychology of Control. Beverly Hills, CA: Sage Publications.

Linn, R.L., Baker, E.L. & Dunbar, S.B. (1991). Complex, performance-based assessment: Expectations and validation criteria. Educational Leadership. 20 (8), 15-23.

Loacker, G., Cromwell, L. & O'Brien, K. (1986). Assessment in higher education: To serve the learner. In C Adelman (Ed.) Assessment in American Higher Education (pp. 47-62). Washington, D.C.: Office of Educational Research and Improvement.

Macdonald, James B., Anderson, Dan W., & May, Frank B. (Eds.). (1965). Strategies of Curriculum Development: Selected Writings of the late Virgil E. Herrick. Columbus, OH: Charles E. Merrill Books, Inc.

Macrorie, K. (1984). Writing to be read. Upper Montclair, NJ: Boynton/Cook.

Marzano, R.J. (1992). Dimensions of learning: A new paradigm for curriculum, instruction and assessment. Alexandria, VA: Association for Supervision and Curriculum Design.

Marzano, R.J. (1991). Cultivating thinking in English and the language arts. Urbana, IL: National Council of Teachers of English.

Marzano, R.J. (1990). Standardized tests: Do they measure general cognitive abilities? NASSP Bulletin 74 (526), 93-101.

Marzano, R.J., Pickering, D.J., Arredondo, D.E., Blackburn, G.J., Brandt, R.S. and Moffett, C. (1992). Dimensions of learning: Teacher's manual. Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R.J., Brandt, R.S., Hughes, C.S., Jones, B.F., Presseisen, B.Z., Rankin, S.C., & Suhor, C. (1988). Dimensions of thinking: A framework for curriculum and instruction. Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R.J. & Costa, A.L. (1988). Question: Do standardized tests measure cognitive skills? Answer: No. Educational Leadership, 45, 66-73.

Marzano, R.J. & Jesse, D.M. (1987). A study of general cognitive operations in two achievement test batteries and their relationship to item difficulty. (Technical Report). Aurora, CO: Mid-continent Regional Educational Laboratory.

McCombs, B. (1986). The role of the self-system in self-regulated learning. Contemporary Educational Psychology, 11, 314-332.

McCombs, B. (1987, April). Issues in the measurement by standardized tests of primary motivation variables related to self-regulated learning. Paper presented at the annual meeting of the American Educational Research Association, Washington, DC.

McCombs, B.L. & Marzano, R.J. (1990). Putting the self in self-regulated learning: The self as agent in integrating will and skill. Educational Psychologist, 25 (1), 51-69.

Mentkowski, M. (1991). Designing a national assessment system: Assessing abilities that connect education and work. Milwaukee: Alverno College.

Mervis, C.B. (1980). Category structure and the development of categorization. In R.J. Sprio, B.C. Bruce & W.F. Brewer (Eds.), Theoretical issues in reading comprehension.(pp. 279-307). Hillsdale, NJ: Erlbaum.

Miller, J.G. (1978). Living systems. New York: McGraw-Hill.

Mullis, I.V.S., Owen, E.H. & Phillips, G.W. (1990). *America's challenge: Accelerating academic achievement (A summary of findings from 20 years of NAEP)*. Princeton, NJ: Educational Testing Service.

National Commission on Excellence in Education (1983). *A nation at risk: The imperative for educational reform*. Washington, DC: Government Printing Office.

National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Nickerson, R.S. (1984). Kinds of thinking taught in current programs. *Educational Leadership*, *42*, 1, 26-37.

Paris, S.G., Lipson, M.Y., & Wixson, K.K. (1983). Becoming a strategic reader. *Contemporary educational psychology*, *8*, 293-316.

Paul, R.(Ed.) (1990). *Critical thinking: What every person needs to survive in a rapidly changing world*. Rohnert Park, CA: Center for Critical Thinking and Moral Critique; Sonoma State University.

Paul, R., Binker, A.J.A., Martin, D., Vetrano, C. & Kreklau, H. (1989). *Critical thinking handbook: Grades 6-9*. Rohnert Park, CA: Center for Critical Thinking and Moral Critique.

Paul, R., Binker, A.S.A., & Charbonneau, M. (1986). Critical thinking handbooks: K-3. A guide for remodeling lesson plans in language arts, social studies, and science. Rohnert Park, CA: Sonoma State University, Center for Critical Thinking and Moral Critique.

Paul, R.W. (1984). Critical thinking: Fundamental to education for a free society. Educational Leadership, 42, 1, 4-14.

Perkins, D.N. (1981). The mind's best work. Cambridge, MA: Harvard University Press.

Perkins, D.N. (1984). Creativity by design. Educational Leadership, 42, 18-25.

Perkins, D.N. (1985). Where is creativity? Paper presented at University of Iowa Second Annual Humanities Symposium, Iowa City, IA.

Peterson, P.L., Swing, S.R., Stark, K.D. & Waas, G.A. (1984). Students' cognitions and time on task during mathematics instruction. American Educational Research Journal, 21 (3), 487-515.

Pulliam, J.D. (1987). History of Education in America (4th edition). Columbus, OH: Merill Publishing Company.

Renzuli, J.S. (1977). The enrichment trial model: A guide for developing defensible programs for the gifted and talented. Mansfield Center, CT: Creative Learning Press.

Resnick, L.B. (1987). Learning in school and out. Educational Researcher 16 (9), 13-20.

Rumelhart, D.E., & Norman, D.A. (1981). Accretion, tuning and restructuring: Three modes of learning. In J.W. Colton & R. Klatzky (Eds.), Semantic factors in cognition. Hillsdale, NJ: Lawrence Erlbaum.

Scardamalia, M., & Bereiter, C. (1986). Research on written composition. In M.C. Wittrock (Ed.), Handbook of research on teaching (3rd ed.) (pp. 778-803). New York: MacMillan Publishing Company.

Scardamalia, M., & Bereiter, C. (1983). Child as co-investigator: Helping children gain insight into their own mental processes. In S. Paris, G. Olson, & H. Stevenson (Eds.), Learning and motivation in the classroom (pp. 61-82). Hillsdale, NJ: Lawrence Erlbaum.

Scriven, M. (1959). The logic of criteria. Journal of Philosophy, LXVI, 357-368.

Secretary's Commission on Achieving Necessary Skills (1991). What work requires of schools. Washington, D.C.: U.S. Department of Labor.

Shepard, L. (1989). Why we need better assessments. Educational Leadership, 46, (7), 41-47.

Siegel, A.I. (1986). Performance tests. In R.A. Beck (Ed.) Performance assessment (pp. 121-142). Baltimore: Johns Hopkins University Press.

Smith, E.E., Adams, N. & Schorr, P. (1978). Fact retrieval and the paradox of interference. Cognitive psychology, 10, 438-464.

Spearman, C. (1927). The abilities of man. New York: MacMillan.

Stahl, R.J. (1985). Cognitive information processes and processing within a uniprocess and processing within a uniprocess superstructure/microstructure framework: A practical information=based model. Unpublished manuscript, University of Arizona, Tucson.

Sternberg, R.J. (1991). Theory-based testing of intellectual abilities: Rationale for the triarchic abilities test. In H.A.H. Rowe (Ed.) Intelligence: Reconceptualization and measurement (pp. 183-202). Hillsdale, NJ: Lawrence Erlbaum Associates.

Sternberg, R.J. (1977). Intelligence, information processing and analogical reasoning: The componential analysis of human abilities. Hillsdale, NJ: Erlbaum.

Sternberg, R.J. (1984a). Beyond IQ: A triarchic theory of human intelligence. New York: Cambridge University Press.

Stiggins, R.J. (1991). Facing the challenges of a new era of educational assessment. Portland, Oregon: Northwest Regional Educational Laboratory.

Sven, H.K. & Davey, B. (April, 1990). Potential theoretical and practical pitfalls and cautions of the performance assessment design. Paper presented at the annual meeting of the American Educational Research Association, Boston.

Tierney, R.J., Carter, M.A. & Desai, L.F. (1991). Portfolio assessment in the reading-writing classroom. Norwood, MA: Christopher - Gordon Publishers.

Torrance, E.P. (1986). Teaching creative and gifted learners. In M.C. Wittrock (Ed.) Handbook of research on teaching: Third edition (pp. 630-647). New York: Macmillan.

Toulmin, S., Rieke, R., & Janik, A. (1981). An introduction to reasoning. New York: Macmillan.

van Manen, Max, (1990). Researching Lived Experience: Human Science for an Action Sensitive Pedagogy. New York: State University of New York Press.

Vosniadou, S., & Brewer, W.F. (1987). Theories of knowledge restructuring and development. Review of Educational Research, 57, 51-67.

Wiggins, G. (1989). Teaching to the (authentic) test. Educational Leadership, 46, (7), 41-47.

Williams, P.L. & Phillips, G.W. (1991). Some measurement issues in performance assessment. Paper presented at the annual meeting of the American Educational Research Association, Chicago.